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Planning Support Systems in the United Kingdom

-The realisation of aims of spatial environmental development by means of using new technologies-

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Structure:

Abstract

The goal of this paper is to contribute to the clarification of the effective use of 'Information Technologies' in landscape planning by examining the application of different components of a planning support system in the UK.
To understand the context in which the models are applied, the English planning system is roughly described from a German perspective, highlighting in particular those features that are handled very differently and those that are under discussion in Germany at present.
In the UK the conditions for planning are different from those in Germany, as the UK planning system is much more centralised. However, the aim of increasing acceptability by enhancing participation is the same in both the British and the German planning systems, In both countries implementation of environmental goals in landscape or urban and country planning is hampered not only by strong economic interests but also by lack of transparency in the decision-making process inside local and regional authorities and by lack of understanding for environmental goals.
Hopes are set on the use of new technologies to improve the situation by creating a better understanding and more sympathy for those goals, encouraging open and active participation and making decisions about environmental matters transparent to the public.
The most important components of an integrated landscape planning support system are: a GIS, tools for the support of communication in public participation (especially via the Internet), visualisation tools and Decision Support Systems (DSS). To achieve such an integrated system many problems still have to be overcome. The here presented study contributes to answering some of the open questions, especially in the area of computer applications. It is based on the knowledge of the situation in Germany and concentrates on experiences with e-enabled planning tools in the United Kingdom.
The findings suggest that the basic components of a landscape planning support system already exist. The main task is one of integrating these components, both in a technical sense and in regard to planning contents and processes. Equally important is the further development of technical possibilities of most components. Especially the visualisation tools must be developed to meet the special needs of users in landscape planning. For example, in the case of detailed GIS-models of larger areas of the landscape, the transmitting of such models over the web and the possibilities to answer user queries in real-time are still restricted. Research about VRML-visualisation has to solve the trade off problems between the level of image detail and refreshment rate file size that is important for real-time performance. In addition, attention should be paid to the development of new visualisation technologies on the base of photographs, which might very well replace VRML application in the near future. Decision Support Systems (DSS), suitable for landscape planning, should be easy to handle and present each step of decision-making or participation in an easily understandable way. Despite this need for development of the technology, it should be possible to create an effective and efficient basic landscape planning support system with the existing components if computer applications are chosen carefully.

In summary, it may be stated, that the basic components of a landscape planning support system already exist. The main task is to integrate these components, both in a technical sense as well as in regard to planning contents and process to create a basic, multi-functional landscape planning support system. However, the functions and technical possibilities of most components, especially the visualisation tools should be developed further, particularly with respect to the special needs of landscape planning. In the area of applications, it is crucial not to get carried away by the possibilities offered by different software packages, but instead to consider very thoroughly the pros and contras of an application in relation to each planning purpose. Especially for visualisation purposes the use of VRML-models at present should be limited to a small spectrum of applications. Most objectives can be satisfied with simpler visualisation technologies that produce more realistic images.

1. Introduction

Background to the research, objectives, and questions

Environmental decisions are made in a social context and their success depends on their being well-founded in the local social framework. Usually, decisions are strongly influenced by economic interests, leaving environmental concerns in a weaker position. Under these conditions, environmental goals have to be very convincing to succeed, especially if supported by what may be an obligatory, but not statutory, planning process, like the German “Landschaftsplanung” (landscape plan). For Environmental planning[1] therefore it is very important,

- that politicians making decisions about environmental options have a good understanding of the problem,
- that planners create an atmosphere of sympathy with nature conservation and environmental matters,
- that planners become well-informed about public interests and certain especially affected groups of stakeholders,
- that open and active participation in the decision-making process is encouraged if and where possible and
- that reasons behind political decisions made about environmental matters are made transparent to the public.

To date, planning does not satisfactorily support these objectives. The processes of spatial development and especially environmental planning are very complex and require a lot of data to inform their solutions. Also, the cross-cutting nature of environmental issues requires an interdisciplinary approach to their solution as well as the input of planning results provided by many different administrations. The complex compilation, generation and presentation of information to date in environmental planning neither favours decision-making in politics and administration, nor encourages public participation. In addition, the acceptability of the planning results is suffering from the scientific nature of the information displayed. Until recently, most planning was carried out in a conventional manner using analogue data. The updating of analogue information is time-consuming and subsequently plans are very often out-of-date shortly after being set up. The plans and the planning results cannot easily be accessed as only a few copies of the plan are produced. Even now, when the use of GIS (geographical information systems) is becoming more common in environmental planning, only very few landscape plans are displayed on the web. These circumstances hinder public participation as well as the everyday use of planning in administration.

As a solution to these problems, the use of methods to structure and display the information in a more user-friendly way and to show a way through the decision-making process has been proposed (Carver et al. 2001; Carver et al. 1998, Kunze 2002, Rubiano 2002, www.nottingham.ac.uk/~lgxjer/ri.htm). Crucial to such solutions is the use of IT and computer applications to support decision-making. This includes not only GIS, already widely used, but to supplement GIS by the use of different components of e-enabled spatial information and a decision support platform. Visualisation tools, scenarios and decision support systems are examples of these components. This platform should be interactive and allow different users to take an active part in the decision making process. To encourage public and stakeholder

[1] The term environmental planning is used here in reference to plans and planning processes, that deal with geographical definable problems of land use and natural resources and biodiversity. The scale of these plans may be very different ranging from a large scale planning (e.g. about the impact and design of certain projects like bridges or houses in a certain side) to small scale plans about the natural functions and the development of a whole region. The term landscape plan is used to describe a certain type of these plans that is obligatory in Germany (but in most German states not statutory). It is set up to create a comprehensive information base and development perspective about the local or regional environment. This should create a supplement to town and country planning and other planning activities.

participation the Internet should be used as an important medium to supply and transfer the required information to different users and to facilitate communication.
To achieve this goal, many problems still have to be overcome. Their nature is partly technical, partly social, and partly in their challenge to existing concepts and methodologies. Some questions that have to be answered include:

1. Which decision support methods are available and suitable to be integrated in such an information and communication platform?
2. How do we address different groups of users in an adequate way?
3. How much information is needed for each group of users? Which building blocs of a planning support system are accepted best?
4. How do we encourage people to take part in the process?
5. In which cases is visualisation crucial in order to improve the process of decision-making or acceptability of environmental goals?
6. How realistic do landscape visualisations or visualisations of ecological processes have to be in order to be accepted by the user? And how do we keep electronic files small enough to be processed on a laptop or even over the Internet?
7. Which existing software packages offer the best results for visualisation on the basis of GIS as a data source?
8. How do we create a user-friendly information and communication system that is easy enough to maintain by an average government municipality, and which can also be handled by different groups of the public?
9. Do any prototype visualisation packages already exist which may simply be pasted into any landscape plan?
10. Interface design: how to construct complex systems?
11. How do we present fuzzy entities, that cannot bounded by lines in a map (landscape amenity entities) or which are no spatial information at al?
12. How to tackle lack of computer skills in some social groups? Must the system address this problem and how?
13. Abuse of the information platform: How do we ensure, that security is not breached and property rights are safeguarded when at the same time we encourage users to contribute local knowledge to the decision space?
14. What should be put into the Internet, what not?
15. How can you link a multicriteria weighing scheme (decision support system in a narrow sense of the word) to a GIS?

The findings of the research into these areas will be integrated into the concept and implementation of an “interactive Landscape Plan”. This pathfinder research project is being carried out in the city of Koeningslutter close to Hannover in northern Germany. The landscape plan will combine the use of GIS, multimedia and other tools to create an interactive multimedia information and communication platform.

Methodology

Some of the above-mentioned questions might, in part, be answered by compiling experiences and information from current research or projects dealing with different aspects of the described complex task. Various groups carry out such research at present all over the world.

The following study will concentrate on experiences with *e*-enabled planning support systems, which include public participation, and GIS-based planning and visualisation tools in the United Kingdom. Examples from other countries and research groups are also included where this is considered helpful.

The UK is an especially interesting country in which to carry out such research because e-enabled public participation is supported very heavily at present by the central government.

Therefore a lot of research activities are being undertaken and many districts are trying to support public participation via the Internet. The conditions for planning are different from those in Germany, as the UK planning system is much more centralised. This has to be taken into consideration as a framework condition in the application of e-enabled planning support systems. However, the aim of increasing acceptability by enhancing participation is the same in both the British and the German planning systems.
To understand the context in which the models are applied, the English planning system is roughly described from a German perspective, highlighting in particular those features that are handled very differently and those that are under discussion in Germany at present.

In the process of using the experience in English planning projects the research has been based partly on using current publications, partly on case studies and interviews with British experts. The case study and interview approach has been chosen, because in this field of knowledge publications are often outdated very quickly. The experience of researchers working in this field and the perception of users of the system is therefore essential for a good understanding of which parts are really usable. Very often by speaking to the researchers themselves, yet unpublished papers could be used. The case studies have been chosen, to represent a variety of application, from visualisation to decision support. The interviews served to back up the research. The views of various people where relevant are placed into the text. In detail the following steps have been carried out:

- Existing research and planning projects documentation dealing with participatory GIS, visualisation of processes, scenarios and objectives, is analysed using the framework of the above-mentioned questions.
- The information is gathered by Internet search and by analysing recent publications. Software and solutions to link different tools are tried and discussed with British researchers.
- Examples of different planning tasks and tools are analysed, application sites are visited and interviews with researchers are carried out.
- Examples are collected in the fields of modelling ecological processes, visualisation of landscape scenes in 2D or 3D and virtual environment, what if scenarios, decisions support systems.

2. The English town and country planning system from a German perspective

The overview of the English planning system serves the purpose of identifying differences and common features compared with the German system. Thus, points may be identified where
a) the use of IT may be helpful in both planning systems,
b) an element of the English system suggests the further development of the German system or the use of IT.

The following section describes the main features of the English planning system (not referring to the Scottish and Northern Ireland systems, which are based on different legislation, but follows similar principles) (SPECTRA project 2002:24).

2.1 Competence and instruments

General characteristic and role of central government

The English planning system is much more centralised than the German federal system. The latter is restricted at a national level to the competence of making a framework law. In the Federal States ("Länder") on 3-4 planning tiers with different competence and powers, the

legal principles of the federal law are implemented; a "counter-current" system between the tiers is supposed to integrate a bottom up approach.
In the English system, central government has the principal policy responsibility. Lack of constitutional constraint allows for this extensive power (Cullingworth, Nadin 2002:9). The root of this major role of the government can be found in the strong tradition of land and countryside preservation and the containment of urban sprawl which in turn are related to the early industrialisation of the UK (Cullingworth, Nadin 2002:10). Local government implements national planning policy and has little formal power to follow up its own interests or goals. Planning on a regional level has developed rapidly during the last years, enforced by central government. This process is still ongoing and decisions about the new powers of the regions are expected soon (Morphet 2002 oral).

Not only is the legislation made exclusively by central government, but also extensive powers of control, supervision and intervention in planning lie in the hands of the Secretaries of State of national government. It publishes policy guidelines in the form of planning policy guidance notes, regional planning guidance and mineral planning guidance (SPECTRA 2002:27). "There is no reference to specific locations or spatial content. Nevertheless, national guidance has become a principal reference point for planning in the UK" (SPECTRA 2002:28). Monitoring reports are supposed to comment on the success of the implementation of the proposals in the central guidelines (*This Common Inheritance, and Sustainable Development, the United Kingdom Strategy).* To picture the extent of government control over the whole planning process, one has to consider that central government decides how many new housing units will have to be developed in every region. Local or regional bodies may make planning proposals which are in accordance with the guidance of central government, but in each planning decision central government will have final approval. However, the system can not be described as totally top down, because central government goes through an extensive consultation process about each regulation. Also, in practise local government has quite extensive freedom of decision in each specific case as long as it follows the framework of the guidelines.

In central government at present, the national Department for Transport, Local Government and the Regions has responsibility for town and country planning (see fig.1 Cullingworth, Nadin 2002:42). Besides this the Department for Environment, Food and Rural Affairs and the Department for Culture, Media and Sports have planning powers that include the right to make an area-specific policy. The Department for Environment, Food and Rural Affairs , for example, creates a classification of the quality of agricultural land, English Nature identifies Sites of Special Scientific Interest (SSSIs) and National Nature Reserves (NNRs), and the Countryside Commission identifies Areas of Outstanding Natural Beauty (AONBs). These sites have to be taken into account in town and country planning. To keep in contact with the regional and local level and to co-ordinate implementation, there are a lot of decentralised offices in national government that very often incorporate more than one of the central government departments (EC 2000:30). In addition, several non-departmental public bodies like the Countryside Agency, English Nature and the Environment Agency have to be informed about planning decisions and will introduce their ideas into the planning process. These institutions do not have the independence of NGOs, in that the government funds them. In addition, the boards of some institutions like English Nature and the Countryside Agency are nominated by the government (while the Environment Agency has an independently-selected board).

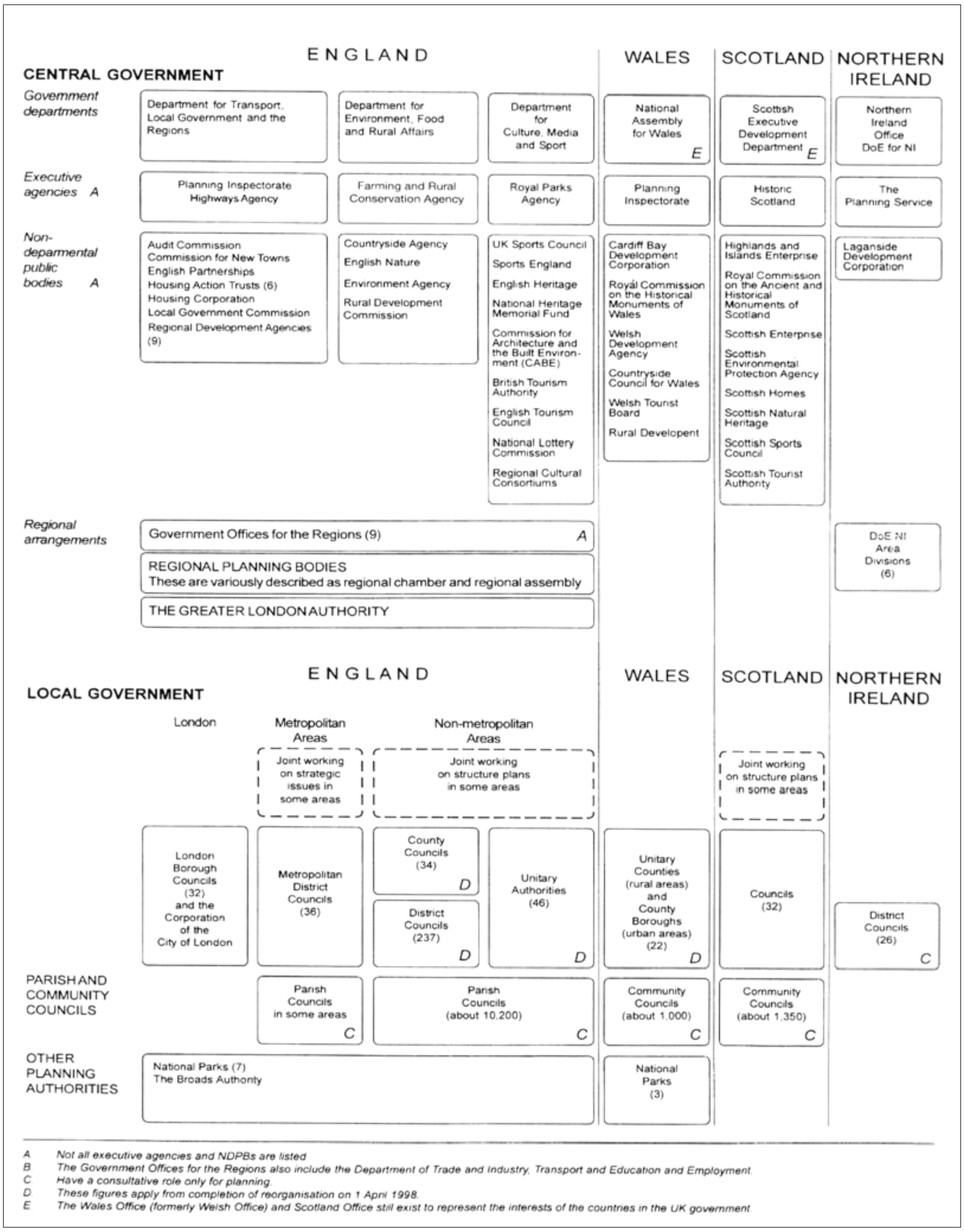

fig.1: The Institutional Arrangements for Town and Country Planning in the UK (from Cullingworth, Nadin 2002:42)

The regional and local level

The rights of the regional planning bodies and the local authorities are very restricted compared with Germany. In the British system there is only limited scope for either regional or local variation, inside the tight framework of central government law, regulations and orders (SPECTRA 2002). However, the implementation of the planning process is left to the local and increasingly to the regional authorities and other planning bodies, who act within national law, policy and control. There is evidence of some opposition at a local level, especially against some of the detailed regulations e.g. about the percentage of brown field sites that ought to be converted into housing. Many local authorities are strongly opposed to development of this kind. While some of the larger British municipalities might compete over economic development, this trend seems not to be as strong as it is in Germany. This is because the British system is not locally, but centrally driven. In Germany this may result in a conflict of interests at a local level, where development provides local economic benefits but might result in harmful impacts on the environment. In England taxes on profits and capital gains of developers and landowners are levied at a national level. Local authorities only levy property taxes and service taxes. Therefore the local communities in England benefit only slightly and indirectly from development in their own district. Planning schemes that are guided by public interests and aim to keep development off certain sites, therefore do not face the same conflict of interests with the private sector as might be the case in Germany.

Planning on the regional level (counties and metropolitan counties) has started to develop rather rapidly during the past years and central government at present is looking at shifting more powers to the regions (Cullingworth, Nadin 2002:53). In England, nine regions have been created, where regional planning takes place. The regions comprise several counties (which resemble in size a German “Landkreis”) and each county consists of several districts. The latter might by compared with a German “Gemeinde” (see table 1). In each region, three institutions are the principal bodies responsible for regional planning:

1) A satellite/local government office represents central government. It will contribute by giving fundamental orientation and it will control the whole process. The adoption of the plans lies in the hands of central government.
2) The second important institution is the Regional Development Agency or RDA. It is run by a board of members nominated by central government. The main task of the RDA is to distribute most of the governmental funding, such as incentives for regeneration, e.g. of former industrial sites. Owing to this funding responsibility, the RDA is therefore very important for the implementation of any regional strategy, often promoting its own agenda while not involving itself in the mechanics of the planning process.
3) The third body integral to the regional planning process is the Regional Assembly. The underlying idea of a democratically legitimised Assembly has been promoted by central government for some years. At present the Assembly is still nominated by the government. It consists of important persons and representatives of institutions from within the region including the local authorities. Referenda about whether to create an independent regional government have to date been rejected. The regions themselves seem as yet to be reluctant to elect this body locally because identification with the only recently created regions has not yet emerged.

The three institutions work together on regional planning as a team (Nadin 2002 oral).

The main planning tool is the regional planning guidance that implies a rather general development strategy but incorporates specific written guidelines. As a recent example, the draft for the Regional Planning guidance for the West-Midlands region (2001) may be quoted. It includes maps with information and analyses e.g. of traffic congestion and also an area Strategy Diagram (sketched map) which gives very general hints where settlements, regeneration and traffic should be developed. At the same time it gives in tables rather specific quantitative requirements for new housing development that the region as a whole has to fulfil or for the required capacity of waste recycling and composting facilities in the sub-regions. Housing proposals are submitted on the basis of three scenarios that are discussed and open to consultation. The scenarios show the requirements under the current policies, further urban concentration or meeting the strategy of the plan (*West Midlands Local Government Association 2001*).

table 1: The Framework of Planning in England and Germany

Planning Level	England	**Germany**
Europe	European Spatial Development Perspective	
National		
- responsible institution	central government, several ministries	central government, several ministries
- general strategy	UK sustainable development	Nachhaltigkeitsstrategie der

	strategy, several laws	Bundesregierung 2002, several laws especially Baugesetzbuch, (BauGB), Rauordnungsgesetz (ROG) Bundesnaturschutzgesetz BNatSchGn.F..
- planning instrument	National planning guidance	Bundesraumordnungsplan (minor influence on state planning) Bundesverkehrswegeplan
- integration of environmental aspects	- independent planning competencies by the Ministry of Environment (e.g. area specific designation of nature conservation areas)	
Regional (as defined by the EU)		
- institution	Regional planning institutions (bodies of or dependent on central government) (11 in UK, in England 9 + Greater London	Länder (States) (elected parliament + government, principal competence for town and country planning in the framework of national law, create specific state laws) 13 + 3 city states, size: 404sqm to70,000sqm.
- planning instrument	Regional planning guidance	Landesraumordnungspläne Specific planning competences of certain departments e.g. for specially designated areas like National Parks
- content, scale	written statements (including quantitative development goals), maps with information, diagram with very broad spatial development policy	written statements, maps with information and planning policy 1.200 000 – 1:500 000 (zoning legally binding for administration in general); Landscape Programm will be integrated
Local		
- **1st tier**: Institution, spatial extent/comparative area	Counties (56 in England, Wales, Scotland (administration)	Counties (324 Landkreise, size: 404sqm to 17,529.35sqm) elected county parliament + administration; County Free Towns (kreisfreie Städte) 110
- planning instrument	Structure plan (e.g. Warwickshire structure plan) Containing written statement and a key diagram with detailed quantitative district housing land allocations (number of dwellings that have to be developed)	counties: Regionaler Raumordnungsplan M: 1:50, 000 with zoning that is legally binding for administration), landscape framework -plan will be integrated)
- **2nd tier**: Institution, spatial extent/comparative area of	District (483 unitary districts)	local communities (Gemeinden) 16 0000 (size,

political unit		e.g. Wentorf 6.8sqm, Frankfurt 248.31sqm)
- tier 2a: planning instrument	Local plan: Structure plan (strategic) District plans (detailed) Structure and district plan both cover the area of a district/unitary development plan Scale: 1: 15 –20 000	Flächennutzungsplan (zoning legally binding for administration) Landscape plan with environmental aspects will be integrated; Scale 1:10 000
- tier 2b: planning instrument	Development plan	Bebauungsplan (becomes law in the sense that it gives the right for development) "Gruenordnungsplan" (open space plan) containing environmental and open space concerns is integrated or becomes part of Bebauungsplan Scale: 1:2-5000

Local authorities are the counties and the cities . They have considerable apparent discretion in deciding about development (EC 1996:27) and basically operate the planning system within the limits of the framework and control of the central government. The planning instruments are structure plans and local district plans (see Cullingworth, Nadin 2001, fig.4.4:100). Both cover the area of a district. The structure plan is of a more strategic character. It makes "in principal decisions" (Nadin 2002 oral).The local district plan is more detailed. It shows where certain developments should be planned. Metropolitan areas and unitary councils put up unitary development plans that comprise the structure and local plans. The structure plan of the Warwickshire County Council (1998-2001) consists of three main parts. A statement of the secretary of state commentates on the decisions and alterations, that have been made and also discusses different arguments that have occurred in the planning process about certain strategies. This provides a considerable degree of transparency about the influence of the government and the process of decision-making for the public. In part two the planning policy and the modifications compared to the older plan are outlined. In part three proposals and principles of the development are given in a written statement. (To give an idea of how detailed this might be, the following example is quoted: "…permanent moorings at canal or riversides should be generally related to existing settlements and will not normally be permitted in the open countryside" (*Warwickshire County Council (1998-2001: 39* - editor's itals). It also comprises the number and general location of different forms of development shown in a diagram, without identifying the precise location..
The preparation of an authority-wide local plan in all areas has been required by law since 1992. By the end of 1998 about 70% of England had up to date adopted local plan cover SPECTRA 20002:30. Recent plans are quite detailed. Local (district) plans comprise area specific maps that show, for instance, areas of landscape beauty and development areas for housing . The scale of the maps varies between 1: 10,000 and 1:15,000 - (used as examples: the Vale of Glamorgan local plan Deposit Draft 1995 ;   Macclesfield Borough Local Plan 1997). Local authorities can impose detailed conditions on the form of development or land use activities. The extent to which these will remain relevant in a context of great uncertainty is questionable. The level of detail of some plans is creating major conflicts at the time taken to formulate policies, which delays their adoption. The same problems occur in Germany, and my be taken as a starting point for the use of IT in order to support the acceptability of planning.

In contrast to the German situation, the content of the land use plans in England do not become mandatory. The pre-war zoning system of legally binding planning schemes, that probably resembled the present German system more closely, has been replaced with a more discretionary system of plans which give guidance in the regulation of development (SPECTRA 2002:26). Decisions about whether or not to allow a certain development proposal, are made on a case to case basis. The term development includes building, engineering, mining operations and certain changes of land use. The local administration checks whether the application accords with the goals and restrictions of the local plan. The local administration has a rather powerful position in these decisions because politicians will usually follow their advice . An increasing number of various minor forms of mostly household development do not need an application to the local authority but are generally permitted (General Permitted Development Order) (SPECTRA2002:27).

Many individual powers in sector planning fields (such as public transport, pollution control, energy, water and sewerage services) rest with other agencies outside local government and are to a considerable degree privatised.

2.2 Integration of sectoral interests

2.2.1 Integration in general

There is a strong tradition of departmental autonomy in the UK, both in central and local government. Few mechanisms ensure integration, and the lack of coordination of policies of policy and spending programmes is commonly criticised (EC 1996:34). But there is an increasing awareness of the need for better coordination of the activities of many different government departments and agencies at the regional level. Greater coordination of funding for economic regeneration and land renewal is also emerging (EC 1996:36).

Though social and economic matters will inevitably be taken into consideration, the objectives, policies and proposals of land use planning must be limited to specific land use questions.
In making decisions, the local planning authority must regard not only the development plan, but also any material consideration which relates to the use and development of land. This aspect of the system should lead to the integration of many different issues.

Local authorities have separate planning departments whose functions are generally separated from other departments (SPECTRA 2002). In recent years there have been efforts to reintegrate certain functions into land use planning. For example, the proposals for roads and other transport infrastructure should be decided within the land use plan making process.
Over recent years there have been many efforts to revise the planning system. The integration aspect has been strengthened, especially by increasing national guidance in providing strategic directions and by increasing institutional integration of national sectoral ministries, especially at the regional level. Integrated regional offices of central government are created which bring together competences for environment and transport.

2.2.2 Integration of environmental information and interests

In local development control, the need to take into account any relevant consideration leads to an integration of environmental matters. Until now, there is no comprehensive information on environmental subjects that has to be taken into account, such as the German landscape plan. But recently the production of catchment management plans (required by the European Water Framework directive) has been supplemented by Local Environmental Agency Plans (LEAPs), which are at a smaller scale, covering a small or sub-catchment area. They cover the full range of topics for which the Environment Agency is responsible – primarily pollution, waste, water, and air quality (Cullingworth, Nadin 2001:214). LEAPs are non-statutory documents, and progress is rather slow. But local authorities are encouraged to take them into account in the review of the development plan. There is wide consultation with local authorities, other bodies and the public, during the preparation of the LEAPs (Cullingworth, Nadin 2001:214). The further development of the LEAPs and the preparation of the river basin management plans may develop into a planning instrument similar to the German landscape plan.

A number of agencies are charged with the conservation of the beauty of the landscape, biodiversity and other environmental issues. They advise central government and other planning authorities. The most important of these bodies are the Countryside Commission and English Nature, both acting exclusively in England. The Countryside Commission is a public body funded by central government that operates in England with 7 regional offices (EC 2000:108). It has statutory responsibility for the conservation and enhancement of the natural beauty and amenity of the countryside in England and the promotion of its enjoyment by the public. It advises the government, planning agencies and other interested organisations in countryside matters (EC 2000:108). It initiates and implements programmes and policies in its own right.
English Nature is a non-departmental government body. It advises the government on nature conservation matters.

Besides the proposals of the various agencies, there are area specific designations which have to be taken into account in planning. Especially relevant for the protection of the environment are the following:

- National Parks, set up by central government. They are an exception in the planning system because local or regional authorities have no rights for planning there. All National Parks have the right for development control and act as local authorities.(EC 2000:107).
- Sites of Special Scientific Interest (SSSIs): Planning authorities are charged with considering the impacts of development on SSSIs. Though the notification of SSSI status should offer protection to the sites, a lot of them have been damaged due to development and other land use activities (EC 2000:110).
- Areas of Outstanding Natural Beauty (AONBs).
- Environmentally Sensitive Areas (ESAs) and Nitrate-Sensitive Areas that are designated by the Ministry of Agriculture.
- Water.

(Cullingworth, Nadin 1995; 2001:279)

Conclusions

A general characteristic of the UK planning system is, that it is more centralised than the German system. The principal power lies in the hands of central government. Another major characteristic is that there is more power of discretion in deciding about a specific case. Plans do not become legally binding documents in the sense that they bind a local authority: plans only guide the local authority. Deviations do not need a special procedure or the amendment of the plan (Cullingham, Nadin 2001: 9). However, currently there are tendencies to curtail this flexibility and to increase certainty and consistency in policy and decision-making (EC 1996:35). There is an expectation that as more plans are put into place there will, at least for a time, be a reduction in the number and scale of conflicts and appeals at the stage of granting development permission (EC 1996:35). As in Germany, there is a strong tradition of departmental autonomy in the UK, both in central and local government. In comparison with the German system, the English system seems to pay more attention to the integration of different interests on a regional scale.

Common to the English as well as to the German systems seems to be the basic idea that planning should guide trends in publicly desirable directions. (see: Cullingham, Nadin 1995:10), although recently in England a decline in the role of local government can be noticed. It is now seen more as an enabler rather than a direct provider (EC 1996: 31). Public investment into the betterment of a development area doesn't have to be repaid by the investor. Also problems like the decline in population of large cities have been traced back to the effects of a strict policy of containment.(EC 2000:116). Therefore this policy is increasingly under question(EC 2000:116).

The rights of landowners in both systems are limited: however, in Germany the landowner has rights and duties defined by the constitution ("Sozialbindung des Eigentums"). In England where no written constitution exists, planning is not officially restricted by strongrights of landowners, since these rights are not legally underpinned to the same degree as in Germany. In both countries there is a growing concern about the preservation of the countryside and the containment of urban sprawl (for UK Cullingham, Nadin 2001, for Germany see: Nachhaltigkeitsstrategie der Bundesregierung 2002). The *UK Strategy* argues that the 'land use planning system is a key instrument for delivering land use and development objectives which are compatible with the aims of sustainable development' (EC1996:26).

3. The role and method of participation in the English planning system

Stakeholder participation, other authorities, public and NGOs

There are no statutory procedural requirements about participation on the national level, but national government has consulted widely on recently published national guidance (SPECTRA 2002:28). The process of preparing the regional guidance includes the involvement of the local authorities, who make draft proposals to the Secretary of State (SPECTRA 2002:28). There may be wide consultations over those proposals, but the final decision rests with the central government. There are proposals, however, to change the system and shift more responsibility onto the regional level. At a local level, the public has an opportunity to comment in the early stages when the planning authority publicises the plan. Subsequently, there are opportunities for formal objection and in the case of local plans, to have the objection considered by an independent inspector.(EC 1996:32). Many local authorities undertake extensive participation exercises beyond the formal requirement. "Generally the public profile of planning decisions has risen considerably over the recent years" (SPECTRA 2002:27) Local authorities inform and consult widely over those decisions. Generally, local authority committee meetings are held in public and agendas, minutes and relevant background papers of these meetings have to be made public. Nevertheless, planning authorities usually receive relatively few responses to consultation exercises (EC 1996:32) Hopes are set on IT to change this situation. Therefore many planning authorities on all planning levels, publish the plans on the Internet nowadays. In this way, access to the information has become much easier for a considerable proportion of the public.
In addition there are provisions for neighbouring land users and certain interest groups (government departments, other agencies) to be notified of the proposal and for them to submit comments. These comments have to be considered along with the proposal.

Formal objection

If permission of a certain development is refused, there is a right to appeal to central government. The final decision is made by the Minister (mostly delegated to civil servants). Only in cases where legal powers given to the administration in charge have been exceeded by the authority, or the government did not follow the law, is it possible to involve the judiciary.

During the past years the rights of land owners and other interested parties formally to object to a plan have been strengthened, while formal requirements for pubic consultation on plans have been reduced (SPECTRA 2002:27). There is some concern that the level of participation causes significant delays in the system (SPECTRA year not specified), especially with larger and controversial issues. But the costs involved and the complexity of the process often work against active participation.

4 Current use of IT in the United Kingdom and Germany

4.1 UK: “e-government” and recent activities

4.1.1 UK-government activities

One of the main obstacles of public participation via the web is the access of citizens to the Internet. In 1997 only 7 million user in UK were accessing the web (Carver et al. 2001:017), (about 1/8 of the total population of the UK). But the number of users is increasing very fast. Compared to 1997 in 1998 the use of the web had increased already by 48% (10.6 million users) (Carver et al. 2001:917) and in June 2001 33 million users accessed the Internet (Jupiter MMXI: http://www.nua.ie.surveys.how_many_online/europe.html).

Computer illiteracy therefore might be considered as a problem, that time will solve in a very short period of time.
In the UK, the Department for Transport, Local Government and the Regions is ambitiously promoting the support of public services through the use of new technologies, as a part of local government modernisation. The goals are very broad and not restricted to the support of town and country planning. Public service delivery in general is to be re-engineered, to provide higher quality and better accessibility. Greater democratic accountability with increased citizen participation and strong community networks should be developed as a result. Part of this aim is to empower all citizens to play an active part in those networks. This will require fundamental changes which put the needs, expectations and wishes of people first. (J. Morphet 2002 oral; DTLR 2001:4; see also: www.local-regions.dtlr.gov.uk/egov/).

The vision of an *e*-government is that through the increase of cheaper forms of communication, greater efficiency in public services will be achieved. This will enable local government to improve its service and to concentrate specialized staff to deal with people and issues which genuinely require their expertise. Multiple channels should help to support this approach. Not only the Internet, but also telephone, digital TV and mobile phone formats are appropriate additions to personal contact. They will help to provide services outside standard working hours which will be available at home, and can be targeted to a wide audience; websites will be used to encourage public consultation. Elections are already supported by on-line voting. Internet access and e-mail is free to all citizens at their local library (DTLR 2001:5,6). A robust national framework will cover authentication, data protection and technical standards (DTRL 2001:7).
Also the support of the integration of different administrative sectors is an explicit target of the UK Government's e-government initiative. A general target that should be achievable by local authorities is to present their service to the public via a seamless front office. This requires strong co-operation between different agencies and the linking of their databases.

To bring about this change, every council is producing an Implementing Electronic Government Statement (IES) as a broad framework strategy with key milestones. Progress in implementing the IES-statement will be monitored. Great emphasis is being put on integrating work across departments and in co-operation with local partners to provide a seamless service for clients. Websites that are citizen-focused will play an important role in this service. The use of GIS and shared databases will help to provide vast amounts of information, tailored to the need of the individual (see DTLR 2002:11).

Online Planning will be an important element of this development. As recent surveys show, matters relating to planning are high on the list of information that the public in UK most wants from their council. Several local authorities have explored ways to meet this demand (see *Pathfinders* below). Also, the Planning Inspectorate is working to develop an *e-enabled,* integrated approach to the whole development control process. This will be achieved by linking agencies and in developing a common form (as a set of case notes) that can be used by all authorities in the country.

To help the councils achieve the targets of e-government by 2005, the government is providing funds of £350m in total. This sum will be split up between Pathfinder projects and general support for further innovations (£25m available for 2001/2 for Pathfinders) and support for widespread roll out of successful solutions.

Pathfinders and other examples for e-enabled planning
The Government has established and is funding 25 cutting-edge Pathfinder projects which will act as a focus for the dissemination of their learning and good practise and which will develop products for national roll-out. New products might be developed by local councils themselves, or together with private-sector partners. The chosen 25 projects involve over 220 councils in all, plus police and health authorities and the private sector (DTLR 2002:23). Only a few of the Pathfinder projects deal with the subject of town and country planning. But there are other councils that have already gone part of the way to *e*-enabled planning. What follows will introduce some examples of town and country planning on the web to illustrate current practice in the UK.

The Wandsworth Pathfinder project is an approach to e-enabled land-use planning (www.wandsworth.gov.uk). Until now the project has concentrated on information about district and planning procedures. The Centre for Advance Spatial Analysis, University College London, develops GIS maps with spatial information. The suitability of these maps for public consultation will be checked. To date www.wandsworth.gov.uk has provided the unitary development plan (draft), containing general information about goals and some maps with spatial information showing e.g. open space deficiencies or green chains and links between open space. Consultation with planning applicants and agents provides information about the desirability of allowing submissions or accepting planning proposals via the Internet. The result shows that most agents think that submitting applications electronically is very important and are also willing to receive appeals and information electronically.

Some other authorities, such as Rutland (www.rutnet.co.uk), Lambeth (www.lambeth.gov.uk), Westminster (www.westminster.gov.uk) and Birmingham (www.birmingham.gov.uk), provide their development plan, planning policies (www.rutnet.co.uk/rcc/structureplan/) and the report of the panel commentating on each plan (inspector's report) online. This information allows anyone to browse through different points of view. Thus, changes to the structure plan throughout the procedure of preparing the plan become transparent to the public. Rutland and Tameside (www.tameside.gov.uk) provide access to all applications on a weekly basis and also show the decisions on each as they are made (www.tameside.gove.uk/planning/index.html). The well-developed Tameside system is not supported by a map or GIS. However, people may find the area to which their application enquiries relate, by typing the application number, the town, site address etc. The Unitary Development Plan, including information about, and goals for, environment and nature conservation, is also provided on the Tameside homepage, including maps with information about conservation sites.

The London Borough of Lambeth is preparing an up-to-date Unitary Development Plan (the first to meet the principles of the new planning green paper). Public interest in commenting on the Council’s ‘Key Issues Paper’ (setting out options and issues that need to be decided upon when the new plan is produced) has been very great. The main issues of over 2,050 written responses may be viewed online.

The online presentation of the Birmingham Unitary Development Plan allows the user to follow in detail alterations made to the deposit draft version plan in the recent year (s. fig.2).

The Birmingham Plan – Alterations and Environmental Appraisal
Proposed Second Deposit Changes, January 2002
(TO BE READ IN CONJUNCTION WITH DEPOSIT ALTERATIONS 2001)

CHAPTER 3 - ENVIRONMENT

Suggested Change in Response to Objection: 216/11 Wildlife Trust for Birmingham and the Black Country

Deposit Draft Version, May 2001	Reason for Change, May 2001	**Suggested Second Deposit Version, January 2002**	**Suggested Reason for Change, January 2002**
3.40 Existing natural areas will continue to be conserved and enhanced in a variety of ways: **(a) The two existing Sites of Special Scientific Interest (SSSIs) - Sutton Park and Edgbaston Pool - and any others which may be designated will continue to be protected in accordance with their statutory status. *Sutton Park will be protected in accordance with its additional status as a***	**Proposed Alteration 3/19** **Para 3.40, Figure 3.1** Reason for change To reflect Sutton Park's recent designation as a National Nature Reserve and the designation of land at Quinton Meadows as a Site of Importance for Nature Conservation. Also amendments to Figure 3.1 to reflect current SINCs in Birmingham.	**3.40 Existing natural areas will continue to be conserved and enhanced in a variety of ways:** **(a) The two existing Sites of Special Scientific Interest (SSSIs) - Sutton Park and Edgbaston Pool - and any others which may be designated will continue to be protected in accordance with their statutory status. *Sutton Park will be protected in accordance with its additional status as a***	**Proposed Alteration 3/19** **Para 3.40, Figure 3.1** Reason for change To reflect Sutton Park's recent designation as a National Nature Reserve and the designation of land at Quinton Meadows as a Site of Importance for Nature Conservation. Also amendments to Figure 3.1 to reflect current SINCs in Birmingham, and additional text to make reference to the types of wildlife habitat present in Birmingham, in accordance with Planning Policy Guidance

fig.2: A proposals map is available showing in detail the proposed development (legend see: http://www.birmingham.gov.uk/Media?MEDIA_ID=3815) as well as the text of the environmental appraisal of the UDP.

Teesdale District Council provides a website that includes all reports awaiting decision, as well as the outcome of committee and other meetings (http://www.teesdale.gov.uk/council/committees.html). To get feedback from users, a questionnaire about their ICT service (information and communications technology) is also placed online (http://www.teesdale.gov.uk/council/ict/index.html).

5. Planning support systems

Planning Support Systems (PSS) is a general term for systems "that have been developed and are being used to support current practice in any public or private sector planning context at any scale" (Geertman 2001:400). The term refers to a system that links the variety of computer-based software tools, which are primarily developed to support planning processes both in terms of generating information as well as of derivation and evaluation of alternative futures (see Geertman 2001:400: Batty, Densham 1996:3). PSS is used in this report as a predominant term to describe integrated systems designed to support the generation and processing of information, the structuring of the decision making processes, to facilitate public participation and to enhance the understanding of complex problems and decision alternatives.
In this broad sense the term covers the instruments needed to reach the objectives that form the background of this research (chapter 1: introduction).

The human component might be tacitly included into this definition (Rubiano 2002) as it is self evident, that the system has to be operated and (depending on the application) some steps will be more easily done without using technical support. Also in meetings, where the PSS is used, it is usually necessary for an expert, who is familiar with information contents and the tolls available, to be present (see Shiffer 1995:9).
According to Klosterman (1999), "PSS have matured into a conception of integrated systems of information and software, which brings together the three components of traditional decision support systems - information, models, and visualization - into the public realm" www.nexpri.nl (see fig.3). In the literature, a variety of conceptual or operational prototypes of PSS can be found ranging from the electronic conference board rooms (Group Decision Support Systems) discussed by Laurini (1998) to the GIS-supported collaborative decision making tools and www-based mediation systems for co-operative spatial planning (www.nexpri.nl).
At present the ideal process of decision making is rarely executed in town and country planning or landscape planning. Only certain elements will be used in the decision process. GIS will be used today on a routine base. But seldom is modelling and forecasting linked to the GIS and even more seldom will political decisions be supported by a tool that makes sure that the process is well structured, that every relevant aspect has been taken into consideration and that the integration of values is transparent to the public.

Tools in a Landscape- PSS are

- GIS and Internet map Servers that provide the access of several people to the necessary information,
- multimedia information systems that improve the ability of the community and decision maker to comprehend the information,
- models that enable may be even a lay-user to create secondary information (e.g. to explore the results of different value settings). (Bishop 1998).
- Visualisation tools
  - Still pictures or Videos that visualise different viewpoints of a given planning site.
  - Real Time visual simulation (virtual reality) that allows a more intuitive interaction with data and creates an environment in which the user feels present. VR provides a dynamic and immediate way to see and experience information. It is also a tool for model building and experimental learning (Bishop 1998:198).

Both in VRML and still pictures augmented reality that can be used. This technology enhances or augments the user's view of the real world with additional information generated from a computer model (Bishop 1998).

- The dissemination of PPS at present could be hindered or slowed down by the following circumstances: The use of spatial modelling systems is not yet widespread and not effectively integrated into the planning process,
- the analytical tasks which planners perform, are very diverse
- the market for public sector software is relatively small whereas the expense of developing and supporting commercial software is high (Geertmann 2001:401).

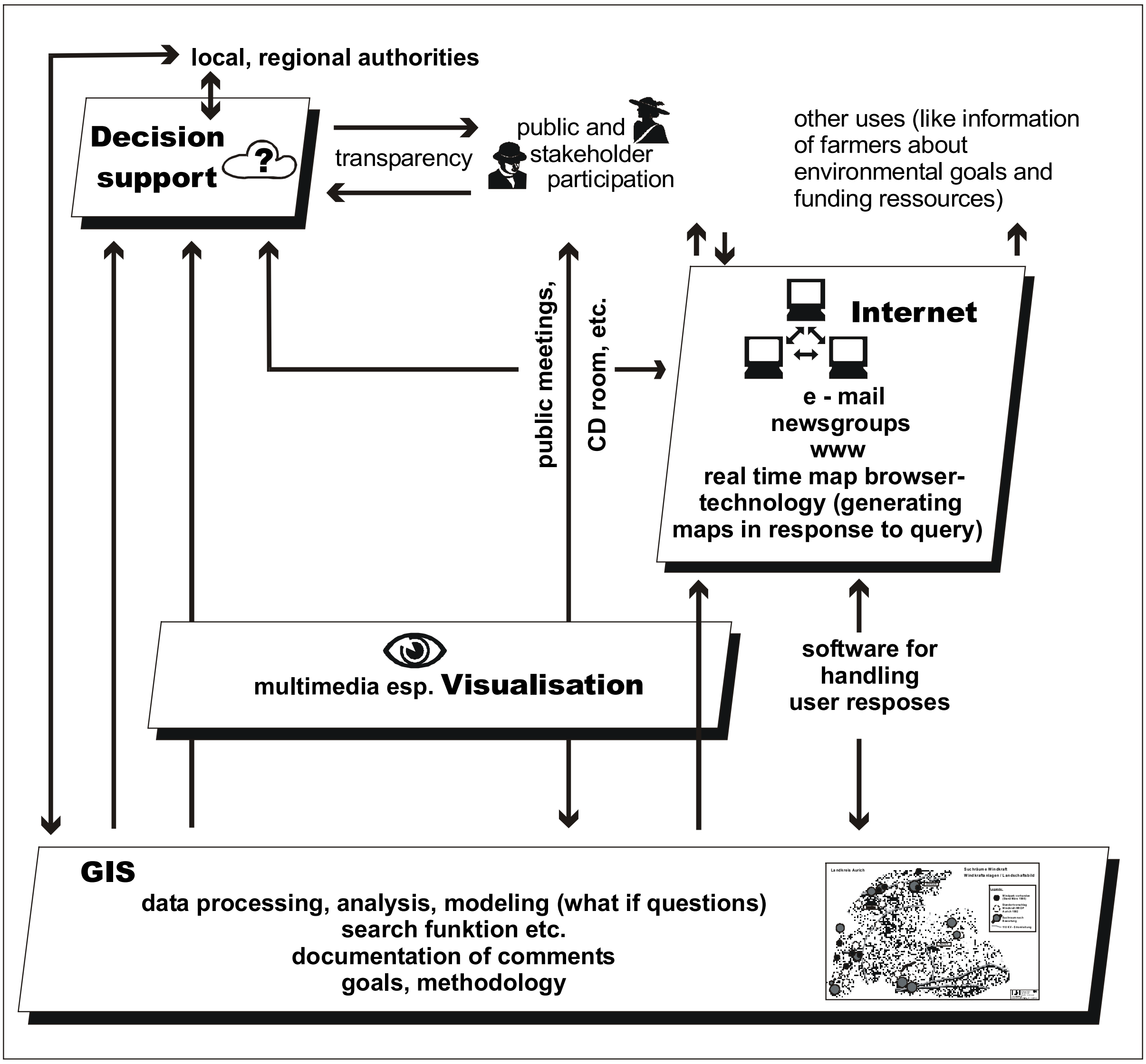

fig.3: Components of an Integrated Landscape Planning Support System

6. Components of a Landscape Planning Support System

6.1 Tools for the support of participation

6.1.1 Geographical Information systems (GIS) in the context of a Landscape Planning Support System

The Geographical Information System (GIS) is the basis of each landscape planning support system. GIS are able to combine the provision of large quantities of spatial information (geographical data) with a wide range of analysis capabilities. In a landscape planning support system the use of GIS is vital, because the integrated information as well as connected interpretations can be changed relatively easily during and after the planning process. The GIS is the basis for generating all spatial information, modelling and forecasting. It may be combined with non-spatial databases, tools for facilitation participation, decision support systems and visualisation.

The challenges for the use of GIS in the context of an interactive multimedia landscape plan today lay primarily in the following fields:

1. To emphasis the use of GIS to answer 'what if?' questions;
2. The connection of GIS with participation tools, VRML and other ways of visualisation or other building blocs of the planning support system.

The accessibility of the GIS via Internet and the measures to protect the information against damage no longer seems to be a real problem (Carver oral 2002). Also the challenge to make GIS easy to use for non-expert users, who are likely to be found in an average local administration, will probably be tackled in the course of the further development of various GIS software. Until then, the documentation of data and methodologies has to be carried out very carefully by the GIS- expert working on the landscape plan, in order to make the system usable for the less skilled user after the expert planners have finished their work.

6.1.2 The abilities of GIS to answer 'What if?' questions

To illustrate the capacities of a GIS to answer “What if?” questions some planning examples shall be presented,

Example: An Alternative Future for the Region of Camp Pendleton, California (Steinitz (Editor) et al. 1996 and 1997)

The project explored urban growth and change in the region between San Diego and Los Angeles from the 1990ies to the years 2010 and 2030.
(http://www.gsd.harvard.edu/~pbcote/data_mgt/intro.html)
The example has been chosen, because it is outstanding in terms of the big number of alternative futures presented (fig.3). The system connects a variety of data and several process models relevant for landscape planning (fig.3). The information is presented in maps (on the base of aerial photographs), graphics, charts and composite layouts. The major product of the research is a computer-based Geographic Information System and a set of models which evaluate the complex dynamic processes of the very large study area and the possible impacts on biodiversity resulting from changes in land use (Steinitz et al. 1997). For example, the soils models evaluate the agricultural productivity of the area's soils. Future change for the region was simulated using the State of California’s regional population projections and the complete implementation, or “build-out,” of the area’s current plans. The projections based on current plans indicate a future urbanization of all currently non-built land in the region (see fig.4).

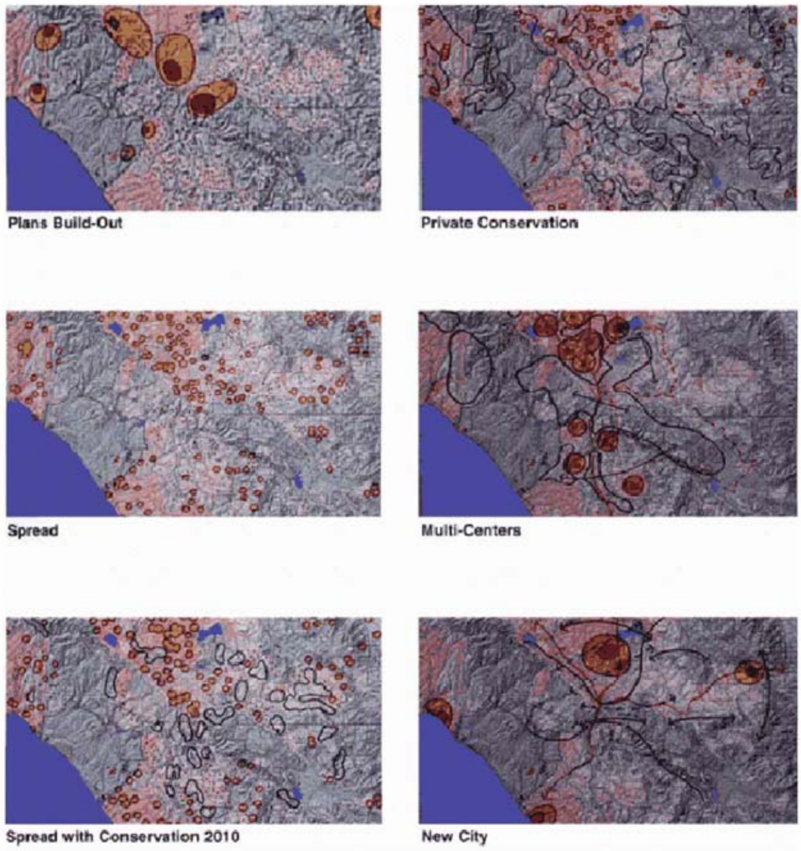

fig.4: Five Alternative Scenarios (in addition to built-out) Modeled Different Development and Conservation Policies.

They illustrate the implications of a continuation of the current spread of extensive single-family and rural-residential growth, with an assumed disregard of the regional plan. The proposals of the alternatives presented range from spread development with or without a major conservation effort in the year 2010 to the proposal of a concentrated growth in a new city. All of the alternatives accommodated the projected population forecast and were then extended to build-out. Probable impacts of the changes caused by the policies are described and shown in maps as well as planning proposals in different scales from regional to local (Steinitz et al. 1997).

The analysis and production architecture follows Steinitz' "framework" (Steinitz et al. 1997), which dominated the structure of the whole project. The graphic illustrates, that a lot of data items, models for analysis and additional technical information for presentation is needed to achieve a comprehensive result.

Considering the time of the creation of the GIS platform it is not surprising, that the project file is very big. The very complicated task of answering “what if?”-questions (which are not prepared in advance) interactively in a public participation meeting or via Internet has not been addressed.

A similar example, but designed for a different scale, the Environmental Explorer NL (of the RIVM) is also worth while examining. It shows the effects of alternative policy options on the quality of the physical environment on a national scale. The model evaluates the effects of different policies on the basis of social, economic and ecological criteria. Values for national indicators like 'open space' and 'built up area' can be viewed as maps or graphs.

Example: Modelling soil detachment and terrain development with hedges

The following examples designed by the Geographic Modelling Systems Laboratory University of Illinois may illustrate the capabilities of a GIS to demonstrate the impacts of different land uses or the change of landscape structures (Mitasova 1999, 2000). Using different methods (e.g. the RUSLE (Universal Soil Loss Equitation) and its modified form for complex terrain), Mitasova succeeds in modelling soil loss with the support of 3 different GIS (GRASS 5.0, Arc View Spatial Analyst and ArcGIS 8.1, ArcMap (GIS). http://www2.gis.uiuc.edu:2280/modviz/erosion/usle.html). The study area is located near Munich, Germany (FAM-Project). Single terrain factors relevant for erosion as well as the resulting predicted soil loss are shown in 3D maps (GRASS, see fig.6 and 7) or as in the case of the Arc View application in 2-D-maps (GRASS, see fig.8).
When using Arc View, Mitasova was not able to visualise in the erosion/deposition map the true values of K and C, because Arc View has troubles handling floating point numbers in the interval <-1,1>. According to the Spatial Analyst manual floating point grid themes can only use equal interval or standard deviation for classification which are unsuitable for erosion/deposition maps. Displaying the maps, some map calculator operations as well as reclassification operations with erosion/deposition maps therefore yield incorrect (results see Mitasova 1999: http://www2.gis.uiuc.edu:2280/modviz/erosion/usped.html).
In another example some factors (erodability and transportability can be viewed as movies (run by windows media player). Alternative land use patterns can be compared in their effects in an overview image.

The SIMWE-model (Mitasova 1998) was used to simulate the impact of hedges under various simplified conditions. The model predicts deposition above and within the hedge and erosion below the hedge. A sequence of images represents the terrain and erosion/deposition after 1, 3 and 6 rainfall-events. An animated gif or mpeg movie showing terrain and erosion/deposition pattern development for all seven events is also available.

6.1.3 The integration of GIS and other building blocs of the landscape planning support system

The need to visualise GIS based data and to distribute the result efficiently via Internet has created a more urgent need to find effective ways to integrate GIS, Virtual Reality (VR) and the Internet closely.
There are two ways of linking GIS to other building blocs:

1. Use the GIS as main platform and embed other models, features and programs in it (De Kluijver, J. Stoter 2000);
2. Embed a limited range of GIS functions within a more elaborate modelling framework.

If heuristic optimisation techniques are linked to GIS, powerful visualisation facilities for display and manipulation are possible, this gives a wide range of non-technical users and decision makers immediate, intuitive evaluation capabilities (Batty/Densham 1996:5).
De Kluijver and Stoter (2000) show the possibilities of the integration of Data derived from different sources in a GIS. In this case noise models are combined with a GIS, which created a powerful tool for increasing the quality and efficiency of noise effect studies by automating the modelling process.

Huang et al. (2001) propose the use of Virtual Reality Modelling Language (VRML) for spatial data visualisation, analysis and exploration by a hybrid approach that merges the conventional client-side and server-side methods. It offers the best of both worlds in terms of flexibility and capability, as well as the rational use of computing resources. The client side is given the responsibility for the final control of the system, as well as basic map operations (e.g. zooming, panning, identifying spatial features.) Simple analysis (e.g. profile, graph creation) as well as VRML interaction are possible. The Geo-V&A-prototype based on this approach provides a flexible interface through the use of JAVA. Though some operation that in former time were performed on the server side are available in this approach for the client side, CGI (common gateway Interface) application are not possible (because a new process has to be started up for each request). The introduction of Java serve lets though might overcome this problem in the future (Huang et al. 2001).

Some other approaches are certainly worth a closer look. For example, Stoter and van Oosterom (2001) developed an approach to change GIS from a static modelling in 2D to dynamic modelling in 3D for the use of the Dutch Cadastre (http://www.geo.tudelft.nl/Gist/mainpage/publicaties.html).

6.2 Principles and tools for the support of participation

6.2.1 Objectives

Traditionally planners prepared a plan and presented it to a group of citizens to get their reaction. Sometimes even the "Decide Announce Defend"-approach was used without giving people the opportunity to modify the plan. This technique is not very likely to create public support (Howard1998:2).A second approach utilises the planners to meet with citizens, record their ideas and develop their goals. This process often results in vague notions that are unsatisfactory or which lack in information based decisions.
Neither of these approaches is satisfactory in landscape planning. The objectives of participation in landscape planning should be, on one hand, to stimulate people to come up with good workable ideas and integrate local knowledge (Howard 1998:2) into the information basis of the planning process. And on the other hand, enable citizens and politicians, through information and the support of understanding, to come to reasonable decisions. In addition, consultation and participation should no longer be limited exclusively to fixed places at fixed times because that excludes a lot of people who are socially or geographically marginalized or for diverse reasons are not able to participate.

6.2.2 Tools

New technologies may support participation in many different ways. Place and time will no longer be a crucial condition for participating. The confrontational nature of many public meetings and their being dominated by minority vocal groups can be altered by use of better information techniques and by gaining anonymous opinions over the Internet. The opinions of citizens may be expressed privately, without the intimidation that occur in public meetings. The difficulties of the layperson to understand highly technical information and legal jargon can be mitigated or eliminated. The whole process of decision-making may become more transparent and already 'stitched-up' decisions less probable (Carver 2002 oral). These advantages should lead to improved democracy and increased empowerment of the citizens. The principal weakness of the approach at present lies in the exclusion of less technologically skilled people. But this disadvantage is likely to be overcome in the near future.

In landscape planning participation will primarily be supported through the following tools:

- **GIS**, which should be accessible over the internet in certain functions and outputs,
- participatory **modelling** of future conditions and situations in the landscape,
- **visualisation techniques,**
- **audio recordings,**
- **DSSs (Decision Support Systems),**
- **E-mail, news-groups, community bulletin boards, online meetings, and discussion forums** on the Internet.

6.2.3 Applications

These tools support a variety of techniques common in participatory processes (see Howard 1998:2). But not every IT tool is appropriate for every participation technique. The following gives examples for the application of IT tools in the support of participation techniques.

- Media campaigns: Multimedia and GIS might support media campaigns to inform and educate the public when delivering pieces of information for TV, radio or print media that are easy to communicate and more likely to be broadcast.
- Involving youth in planning: Youth communicate information and ideas back into their families, they are the future community and decision-makers, and they may contribute fresh unconventional ideas. Youths are especially interested and capable in using IT and might support their parents in using the new media (Carver et al. 2001, see chapter 7). Youths are likely not only to use new technologies, but to demand them (Howard 1998:2). If the technology and information is introduced to schools, teachers will usually be glad to give children homework based around significant local issues. Attention should be paid to the modification of techniques for application to children.
- Information delivery: In general, using the Internet and/or terminals in public places will facilitate communication. This should be supplemented by the use of CDs with more detailed information. The goal is to create knowledge about certain issues as well as a better understanding and acceptability of environmental goals. Visualisation, audio and digital maps and virtual worlds facilitate this process. It should be provided for relevant local groups, NGOs and stakeholders to get access to the data.
- Collecting feedback from stakeholders and other members of the public: Feedback e.g. about the mapped information as well as concerning development proposals may be more easily gathered by using the Internet as a communication medium. Stakeholders may find their property on digital maps and indicate their wishes or correct information about ecological information (like visible soil erosion).
- Visual preference survey: The goal of visual preference surveys is to give individuals or a group the opportunity to vote on their preferences about the desired character and appearance of their community and to come to a consensus. They may be supported by visualisations and modelling of future landscape situation. The process will be guided and the information about people's opinions will be processed by a DSS.
- Guided tours: Maps, images (produced with IT support) may increase the awareness of certain features or not obvious information about the landscape: virtual worlds and connected information can prepare guided tours in advance by supporting orientation and understanding.
- Meetings, group sessions (neighbourhood groups, interest groups, decision making politics): Digital maps, visualisation techniques, DSS, presentation software, all facilitate groups meetings and decision-making and should lead to a better understanding of the relevant problems. *E-mail*, news-groups, community bulletin boards, online meetings, and discussion forums support preparation for meetings and might partly replace them.
- Visioning (establishing a common vision about the future) will take place in meetings or over the Internet and can be supported by GIS and visualisation techniques (see Howard 1998).

The danger of hampering public participation because of visualisations that look too polished and "final" (Krygier 1998:5) could be tackled by creating "non-threatening" graphics and other facilities of interaction like e.g.:

- A more sketchy appearance of the graphics,
- Moving people through increasing levels of complexity,
- Using game- and role-playing metaphors,
- Allowing people to explore issues at home (rather than in a public meeting) (Krygier 1998: 6)

In principle digital spatial data and software needed for participation might be made available to community groups and individuals in many ways like by CD-ROM, in assemblies etc. However diverse the delivery of information and the application of different IT tools during the planning process is, "nearly all planning information possesses a spatial orientation that is essential to acquiring the knowledge for effective planning participation" (Shiffer 1996). The fact, that most of local government information is spatial (Chorley report, 1985 in Kingston, see http://www.geog.leeds.ac.uk/presentations/o2-1/02-1_files/frame.htm) underpins this claim.

Therefore in this chapter a special emphasis will be placed on participation tools that are compatible and combined to GIS (participatory GIS PPGIS). Other tools that also contribute to participation support like "ordinary", basic GIS-functions, visualisation techniques and DSS are covered under the chapters 6.1-6.4. Tools like news-groups, community bulletin boards, online meetings, and discussion forums and audio techniques have not been examined more closely in this research.

6.2.4 GIS-based participation

Abilities of Participatory GIS

Participation tools, based on or linked to GIS make GIS-data and functions available for collaborative decision making and public participation. They facilitate the delivery of spatial information to participants and allows them to return their information for inclusion in the database24h/day (SEI).

The knowledge, perceptions and priorities of citizens may be integrated into a spatial database (see: http://www.iapad.org/participatory_gis.htm). Thus participatory GIS has the potential for increasing 'bottom-up' inputs into government agencies' decision-making (SEI:3). A disadvantage of participatory GIS may be the cost and complexity of the equipment, which might be hard to access for a small community. Also the final ownership and the use of commonly generated information is still an unsolved question.

However, the advantages of developing participatory GIS and flagging up those parts of it accessible over the Internet (Kingston, Evans 2002 oral) clearly overrule the disadvantages. Appropriate Technology and Examples for the design of GIS-based participation Sites It seems that the University of Leeds carries out the most advanced work in participatory GIS in Britain. In the PPGIS for Slaithwaite users can perform zoom and pan operations, identify sites and objects and add comments and suggestions. It is also possible to read the comments of other users. All user input is stored in the Web access logs and is used for analysis and feedback into the planning process (Kingston et al. 1999:3). In the research, good experience was made with structuring the information as a file tree, as well as following standard usability guidelines (see for example http://www.useit.com/), and testing the system with a broad range of users.

The system was implemented using the vector classes from "Geotools" (created at the University of Leeds), a Java class package for the display and querying of ESRI shape files (www.geo-tools.com.org). The user responses were handled using Perl server-site scripts and html forms (Evans, Carver 2002 oral). A case study examines the design of the project more closely (see Slaithwaite, s. chapter 7.2).

Carver et al. (p.c.) are considering the difficulties of controlling abuse of the web site controllable. Joke replies are usually obvious. Equally obvious are automated multiple returns and those initiated by on-line campaigns. Maintaining good access logs tied to the return data will allow you to assess returns from a single machine over a short period of time, and postcodes can be checked against addresses if gained (Evans, Kingston under http://www.ccg.leeds.ac.uk/).

Other interesting examples for successful PPGIS can be found in the USA, where a lot of activities in participatory GIS have been going on since 1990. Some of these examples are quoted here to further exemplify the potentials of PPGIS.

A project carried out for a neighbourhood in Buffalo NY (Krygier year not specified, Krygier 1998) showed, that the most appropriate technology for providing mapping and GIS capabilities on the Internet seems to be the real-time map browser technology (Carver p.c., Krygier 1998). The process of GIS analysis and generating maps in response to a user's query was automated with the use of a map generator. Users set the parameters of a GIS analysis on a www-based form, which is passed to the map or GIS-server. The server will generate the results of the request and post them on the www-page (Krygier 1998:3). ESRIs Map Objects and Internet Map Server were considered as appropriate software packages, that provide the basic set of www-based mapping and GIS functions needed. A prototype www site has been programmed in the Buffalo project (Krygier 1998). It allows users to zoom in and out, re-centre the map and it provides hot links to additional information. Also more sophisticated functions, like identifying items or adding comments about a lot or building, are available. These comments are posted to the web page. In order to eradicate the problems combined with more elaborate GIS functions, Krygier proposes restricting the ability to change the database behind the map to "master users" such as community planners. Software and programming skills needed for creating the site were Map Objects, Map Object Internet Server, Arc View, Visual Basic, CGL, and HTML (Krygier 1998:4). Krygier expresses the opinion that www-based mapping is possible and many of the technological problems have been solved. This approach is much quicker and not as time-consuming as having the user perform their own analysis on their own computer after acquiring the data (from a www-based spatial library) and the software or a GIS analysis performed by an expert who carries out the generation of maps in response to a query from an interested user and puts the result on the www. However, real time map browser technology requires a reasonable investment in money and time to get the applications working. Besides, the purchase of software, like Map Objects and Internet Map Server, some programming will still be needed to create the site. In the Buffalo project 250 hours were needed for this including the necessary digitising of maps (Krygier 1998:5).

Metro, the regional government for the Portland metropolitan area, utilised GIS technology to engage citizens and policy-makers in making informed decisions about issues related to growth management (Bosworth, Donovan 1998). The authority distributed CD-ROMs with GIS data in a convenient format for desktop mapping. This single product has opened up the distribution of GIS to a much greater audience than had formerly been possible; the structure and format of the GIS data in this product have become the common language for data exchange and data usage in this region (opp.cit.). In addition, Metro employed a multicriteria weighting scheme (URSA) linked to the GIS which enabled elected officials, planners and citizens to compare the suitability of alternative developments. A web-based view of the database available to the public via the Internet allows access to multiple layers of geographic information with some limited spatial analysis tools (http://www.metro-region.org/metromap). The major analysing function is a point in polygon tool, giving users the ability to determine what geography a location is 'in'. Besides that, boundary information (political, ecological boundaries and infrastructure) can be given interactively (Bosworth, Donovan 1998:3).

An example for the successful integration and empowerment of NGOs into the planning process has been carried out by the New Jersey Department of Environmental Protection (NJDEP) (Tulloch et al. 1998). GIS-enabled NGOs have the potential to represent a human 'interface' to the rest of the population that is usually not sufficiently technically skilled to use more elaborate GIS functions. The NJDEP disseminated data in a CD-ROM series beginning in 1996 and distributed specially attained "free" licenses of ESRIs Arc View to local government agencies and environmentally orientated NGOs. The result was that the organisations used GIS in an extensive way and reported that their ability to produce sophisticated map products has earned them greater influence in local decisions as the local boards reacted strongly to these map products (Tulloch et al. 1998:3).

Data-Sharing, collaborative use of GIS
One purpose linked to the use of GIS and making it accessible through the use of CD-ROM or the Internet, is the possibility of sharing data more efficiently than it is the case to date in data collecting and storing. A big advantage of digital data is that its distribution is much easier and cheaper than the distribution of analogue information. However, in many cases, technical problems or the denial of access, or setting too high a price on geographic data may hamper the use of the data. Data-sharing often makes slow progress, because it threatens the autonomy of particular agencies (Ingerson, Cook 2000), data possession rights might be violated, data-sharing may depend on time consuming co-operation, or the hard and software used in different agencies might not favour the efficient exchange of digital data.

In the USA efforts have been undertaken to support data sharing and to mitigate against some of the described difficulties especially in order to facilitate the establishment of a National Spatial Data Infrastructure. Though this data collection is based on locally produced data sets, the data has to be produced and maintained according to specific common procedures and standards set up by the Federal Geographic Data Committee. The data is held in the public domain and access is possible through a searchable Internet-based clearinghouse (Poore 1998:1).
Faber (year not specified) outlines the development of GIS from a single user-tool to a collaborative GIS, that provides an interactive real-time environment for the debate of planning issues. Such a collaborative GIS should even be designed for the lay user, who will be a novice to GIS application.
Further research into collaborate production of GIS has to concentrate on the streamlining or redefinition of future production, quality control and updating activities in major mapping and charting organisations (Coleman, Brooks year not specified).

Experiences in the UK concerning the needs of users
The reaction of the user to the Internet site as observed by Carver et al. (p.c., see also Kingston http://www.ccg.leeds.ac.uk) led to the following proposals:

- To encourage participants to give their opinion allow users to see other responses and to opt-into putting email contact details for others on-line.
- Users should not be overloaded by information. The research group found, that most users responded well to large tick box questionnaires, but would only interact with 5 to 7 factors on a weighting map. A potential solution for situations with more issues is to explicitly force the user to pick the families of issues they believe are important on a questionnaire before generating the appropriate styled GIS automatically.
- Hints about the user-friendliness of the system might also be gained from watching people drop out of the system. "If you collect demographic data early, and don't rely on a *single* final button push to submit information you can monitor whether drop-outs occur because of usability problems or because particular groups are finding the system unengaging Make sure your system doesn't break if people don't traverse the whole thing"(Evans, Kingston under http://www.ccg.leeds.ac.uk/).
- To encourage trust and belief in the information and methodology, information should be given bipartisan in allowing people to leave to external sites, and link to contrary viewpoints. Also secure the certification of data by all the groups involved. Disagreement over interpretation should be explicitly expressed and users should be allowed to add their own data or interpretations.
- To encourage belief that something is being done to prevent against abuse of the system, explicit details of what will be done with the information should be given und confidentiality should be assured. Also time for on-line consultation should be limited explicitly. Users can be encouraged to sign up to email news bulletins or enter an email newsgroup. It should be optional for participants to supply demographic information.

See complete recommendations under http://www.ccg.leeds.ac.uk/)

By analysing the responses of several PPGIS-projects on the Internet, Carver et al. (2001:918) found that spatial scale obviously has a significant impact on the way and amount of participation. The majority of people are interested in local problems and decisions that pertain to their area and thus affect them directly (Carver et al. 2001:918, reference see case studies). On a regional or especially on a national level, the percentage of participants compared to the addressed population decreases substantially and it is also observed that only certain groups of already interested people or stakeholder representatives take part (Carver 2002 oral). This fact has to be taken into consideration when decisions are made in landscape planning about whom to address with an email campaign, or in the process of evaluation of comments made by the public. In local planning processes, for example, comments made by organisations outside of the affected area should be treated differently than comments of local citizens.

Besides these practical findings, the Slaithwaite example also raises a more fundamental question. During the "Shaping Slaithwaite" event (open day) most users still preferred a solid model to the GIS for giving their comments (nearly 1,100 suggestions were placed on the model (Seanor 2002 p.c.) whereas *far fewer people* used the computer). These findings indicate that a solid model is still more attractive and less threatening for the majority of people than the use of a PC. With growing computer skills of the population this situation may change very fast. In the Slaithwaite project in general, most users were school children (more than 50%), followed by people from professional management (about 25 %). These figures show that the use of IT in planning might be considered as an investment for the future. It also has to be considered that the building of a solid model is time consuming, expensive and probably will not be done for the whole territory of a local community. As we have no comparison about the use of GIS versus analogue maps we don't know for sure whether 2Dmaps are really less favourable than the computer presentation. However, the disadvantages of relying exclusively on maps have been stated several times before.
The findings in Slaithwaite should remind us, that we should not be carried away by too great a belief in new technologies. The use of the new media is still not widespread enough to rely on it exclusively in public participation. Apart from providing information and participation functions over the Internet or some terminals open to the public, enough effort must be put into public presentations, meetings and other techniques.

A very close survey and evaluation of a GIS-based public participation in Wandsworth (an inner London borough) also produced very interesting results that should be considered in the future design and use of GIS as a tool for public participation. Participants in the workshops that were the object of the empirical study consisted mainly of active and well-informed people with various computer skills. Trained facilitators (researcher and students working as "chauffeurs") helped participants to navigate the system. The spectrum of advice offered covered a wide variety of functions, starting with the operating of a mouse up to using sophisticated analytical GIS functions. The results of the survey propose, that "GIS and ICT-based planning service cannot be separated from wider questions about the legitimacy of the planning process and of local government. Participants acknowledged that PPGIS could be very useful in supporting public participation. In particular the availability of information and the facilities to examine the spatial outcomes of alternative policy scenarios are thought to help empower citizens and to overcome the NIMBY (Not In My Back Yard) responses provoked by conventional public consultation practice. However, GIS alone and even GIS on the www is not enough to improve public participation. It has to be used in a context that encourages public participation. Local activists felt empowered by the increase of information but were also sensitive towards the question of who controls the information. Scepticism was expressed about the willingness of local authorities to provide the public with the same information and criteria on which the decisions of planners and local politicians will be based. However, most residents were more likely to trust the local authority to provide the information, to which they desired access. Thus the study shows clearly, that the use of PPGIS is context based. A prerequisite of a successful PPGIS is that local authorities are willing to act responsively and as enforcer and enabler of public participation. Nevertheless it will be more difficult for local authorities to hold back information and criteria crucial for decision making if the public is expecting that kind of information accessible via the Internet.

Abstract and Conclusion

New technologies may support participation in many different ways. Place and time will no longer be a crucial condition for participating. Empowerment of citizens is possible by information and better understanding of the problems through visualisation techniques. Information and decision criteria used by those who make the decisions can be made easily

available for everybody in order to improve democracy through a high degree of transparency. “What- if” scenarios that show the consequences in other parts of the area can stimulate context-oriented discussion and weaken the NIMBY principle. Gaining anonymous opinions over the Internet avoids the intimidation that people sometimes feel at public meetings and may mitigate against the confrontational nature of many public meetings.
The principal weakness of the approach at present lies in the exclusion of less technologically skilled people. But, this disadvantage is likely to be overcome in the near future. The danger of hampering public participation because of visualisations that look too polished and "final" could be tackled by creating "non-threatening" graphics and allowing the public to follow the creation of information and decisions at their own speed.

IT tools in landscape planning can especially support the general information delivery (by www and CD-ROM), the ability to explore planning alternatives, to collect feed- back from the public and stakeholders, visual preference surveys, the involvement of children and young people as future citizens and links to the elder generation.
However, the benefits of the use of IT to support public participation is, clearly, also context based. A prerequisite of a successful PPGIS is that local authorities are willing to be responsive and act as enforcer and enabler of public participation. Nevertheless, it will be more difficult for local authorities to withhold information and criteria crucial for decision-making if the public is expecting this kind of information to be accessible via the Internet.

Case studies and other examples show, that a web-based view of the database served to the public via the Internet allows access to multiple layers of geographic information with some limited spatial analysis tools (like zoom, pan, identify, and further information about boundaries, ecological or political features should be given interactively). Also, the user should be allowed to submit comments or add further information. Ability to make changes to the database should, however, be limited to certain users, such as local community planners. The danger of abuse in adding comments is considered controllable by experts. Automated multiple comments (initiated by online campaigns), for example, or returns from a location not involved in the planning process can be easily identified by those who collect the information. In addition, it is possible to filter out inappropriate comments.

Appropriate technology for the implementation of PPGIS by real time map browser (that automates the process of GIS analysis and generating maps in response to a query with the use of a map generator) is already available (e.g. Geotools”/Evans et al., University of Leeds, a Java class package for the display and querying of ESRI shape files or the ESRI-software packages like Map Objects and Internet Map Server). But setting up the prototype Internet site and handling the user responses still needs some programming.

The distribution of a CD-ROM with GIS data in a convenient format for desktop mapping and of specially attained "free" licenses of GIS software to local government agencies and environmentally-orientated NGOs, showed good results for the delivery of information and involving NGOs in an active role in the planning process:

- Data sharing and the collaborative use of GIS should be encouraged and facilitated through clearly defined rules (set up by the government);
- Free access and reasonable, low prices for access to information collected by governmental agencies or based on public funding should be available;
- Collaboration between various local and regional agencies should be encouraged.

To assure the user-friendliness of the system and encourage trust in the information and methodology used, the following recommendations are made:

1. Structure information as a file tree and follow standard usability guidelines.
2. Explicitly force the user to pick the families of issues they believe are important on a questionnaire before generating the appropriate styled GIS automatically.

3. Allow users to see other responses.
4. Ensure that the information given is bipartisan and allow users to add their own data or interpretations.
5. Allow people to link to external sites, and to contrary viewpoints. Allow users to add their own data/information.
6. Give details of what will be done with the information and ensure confidentiality.

   See http://www.ccg.leeds.ac.uk/):

It must not be forgotten that the use of new media, and especially PPGIS is still not widespread enough to rely on it exclusively in public participation. Apart from providing information and participation functions over the Internet or public terminals, there must be put enough effort into public presentations, meetings and other techniques.

6.3 Landscape visualisation

6.3.1 Goals and applications

The quantity of environmental information has become vast over recent decades and will probably explode in the future. This phenomenon calls for more and improved methods to process information and to present it in a way that decision-makers and the public are still able to understand the problem discussed. (see Bishop 2000). In addition the public's ability to understand a map has been questioned by several pieces of research (Kingston et al. 1999:2; see also Keates 1996). Therefore more realistic, "human- eye" visualisations should be used much more for the presentation of planning information.

Methods for visualisation in the past included maps, aerial photographs, scale models, drawings and photographs (see e.g. Shafer, Brush 1977) and photomontage. Only recently has more effort been put into creating more complex 3D visualisation of landscapes and their potential future changes from GIS databases. The goal of using 3D visualisation in landscape planning is to improve the communication of information needed to understand a planning problem. 3D visualisation does this in a way that is more transparent and easier to understand than a 2-dimensional plan accompanied by written information. Visual presentations in general can be comprehended easily also by lay people (Counsell 2002). Many people do not understand a map (Monmonier 1996, Keates 1996) or do not instantly recognise a location when it is presented to them as an aerial view (Bulmer 2001). A map is essentially an abstract "birds- eye" view of a place and does not correspond with human everyday experience. The public is potentially more open to photo-realistic information than, e.g. maps or professional drawings which are not easy to understand without training (Counsell 2002). Research in the perception of information in other fields (like Museums and Galleries) has proved that people show more interest in dynamic, animated, or changing presentations than in flat, static work. This suggests a greater preference for 3-dimensional presentations (diverse authors in Counsell 2002). Interactive participation seems to be particularly important for younger audiences. Visitors in exhibitions are discouraged by reading while looking at an object. They prefer an audio commentary and want to be entertained (see in Counsell 2002:2). Compared to conventional maps, imagery and data provided in more than two dimensions and multimedia (non tabular data) are better understood intuitively and thus have the effect of widening access to information in a decision making process (Neves, Camara 1999, Daniel 1992 in Bishop et al. 2001:226). These findings suggest that in landscape planning, too the use of 3D interactive visualisations should be enhanced. 3D visualisation in landscape planning can be used for 1) exploring planning sites, 2) previewing and communicating planning scenarios, 3) monitoring people's behaviour and preferences.

1) As many people do not easily understand maps, 3D visualisations may be used for support of orientation during the planning process. Conventional maps inhibit exploration because they are static (Jiang, Huang, Vasek 2001). A 3D interactive model may allow exploration of the landscape in different ways, such as zoom, pan, fly over, walking through, rotate, perspective change etc. (Jiang et al. 2001:407). The scene may also be published via the Internet and thus enhance participation. A digital model used for the purpose of orientation could also function as an interface to access additional data about the site, as well as prepare and invite the user to an on-site experience in the real landscape.
2) For the purpose of previewing and communicating planning scenarios, comprehensive computer visualisation may be used to provide a context for the visual impact of a single planned development or show a proposed landscape change that would affect a large area (e.g. the visual impact of increasing the total percentage of hedgerows over a wide area). Thus presented, the information would be more readily understood by politicians and the public.
3) Virtual environments might also be used to support assessment of existing landscape features by monitoring people's behaviour and preferences (Bishop, Wherrett, Miller 2001:225) and to support participation in developing new landscape amenities.

6.3.2 Survey of the pros and cons of different visualisation approaches

Spatial digital information forms a new medium that should best be employed in new forms, not simply replacing previous approaches (Counsell 2002:1). Therefore, the use of maps and 2D photographs or sketches does not become unnecessary when 3D visualisations are introduced. It must not be forgotten that the use of 3D visualisations may also create barriers to understanding. Even more likely is that planners can get carried away by the possibilities offered by the technique or program and apply it even when the source data is already sufficient to inform the public. For landscape planning the most important question to be answered is to determine which visualisation technologies make sense in this context and in which case they should be recommended.
There are mainly three screen based (virtual) methods of landscape visualisation:

1) Non-interactive still images
   -2D terrestrial photos
   -orthogonal and perspective aerial photos
   -3D still images based on GIS data,
2) 3D fully interactive models (on the basis of GIS and VRML)
   - 3D terrain model + image draping
   - virtual worlds
3) 3D visualisation on the base of photos with limited interactivity

Some visualisations use GIS as the primary database, others are based on photographs or other data. Dependent on the planning purpose there are advantages as well as disadvantages associated with both approaches

The big advantage of connecting the visualisation to a GIS database lies in the possibility of replacing the above-mentioned time-consuming methods with a technology that allows the processing of large amounts of complex information in a comparatively short time. In addition, given the fact that landscape planning will be based on GIS as a standard in the near future, the connection of GIS and visualisation allows the easy follow-up presentation of relevant changes made to the GIS database with a visualisation. This enables the system not only to follow up changes made to planning proposals during the initial planning, but also amend information which has been added over the years. The combination of GIS and visualisation software is especially crucial if planning is considered to be a process, which requires the study of several alternative scenarios and will include many iterations before reaching a consensus. In this case it should be possible to modify the visualisation through the mere editing of a few parameters (Perrin et al. 2001).

If only a small site has to be visualised, it can be disadvantageous to produce huge files using the GIS as a database in combination with visualisation software to create a virtual world. Instead it may be recommended to create a visualisation on the basis of digital photos which can also be rendered [2]as a 3D image which enables the user to move around the image (Andrew Hudson-Smith 18/0702 p.c.).

If a model is supposed to be accessible over the Internet, it must be taken into account that presently only a limited amount of data can be broadcasted over the Internet. The user will not want to download huge files. And system response times in an interactive approach will have to be fast. This fact currently impedes the satisfactory broadcast of models for larger parts of the landscape, more detailed images and complex 3D urban models, such as models of Bath, Edinburgh (Counsell 2002:3) or virtual London. The last mentioned model needs particularly great computer capacities and therefore has never gone on the web (Andrew Hudson- Smith 18/07/02 p.c.). But improvements in network bandwidth, and computer technology will probably facilitate complex interactive experiences in virtual worlds in the near future (Counsell 2002:3).

The need for visualisation should be considered right at the beginning of a project, because it should be taken into account during the collection or collation of data. A pre-existing database is likely to need modification. Suitable data does not necessarily mean very detailed data. In particular, attention should be paid to the level of detail accepted by a visualisation package and the loss of information in the rendering process. In spite of the different requirements of the software packages, generally it seems to be possible to create a master dataset from which the relevant information can be extracted (Appleton et al. 2002).It also has to be considered in each planning case whether more effective use can be made of video or images instead of 3D modelling[3].

An assessment of several software packages concerning their suitability for different types of visualisation has been carried out by Appleton et al. (2001) (http://www.enva2.env.uea.ac.uk/~e907122/papers/gisruk01/gisruk2001.html). It covers the following Software and Tools:

3D photorealistic rendering of stills images

- GenesisII (Geomantics), http://www.geomantics.com/software.html
- Visual Nature Studio from World Construction Set (3DNature), http://www.3DNature.com/
- Software ruled out as inappropriate by Appleton et al. (2001) because of their inability to accept GIS data: World Builder (AnimaTek), http://www.digi-element.com/; Bryce (Corel) takes USGS DEM but no vector info expect in DXF, http://www.newgraphics.corel.com/products/bryce4.html; Terragen (Planetside) accepts DEM but does not import vector data, http://www.planetside.co.uk/; World Builder (AmikaTek)

image Draping:

- Landscape Explorer 2000 (Geomantics), http://www.geomantics.com/le2000.htm
- Imagine (ERDAS), http://www.erdas.com/products/product.htm
- ArcView 3D Analyst (ESRI),
http://www.esri.com/software/arcview/extensions/3dext.htm

[2] Rendering is the process creating the visual surface. It includes applying texture maps and defining lighting parameters (Mahmoud 1998:4)

[3] Modelling in the context of VR is the process of building the geometry and physical attributes of objects that constitute the virtual environment (Mahmoud 1998:4)

virtual worlds, VRML:

- Pavan (Infotech Enterprises Europe), http://www.pavan.co.uk/;
- SiteBuilder 3D (MultiGen-Paradigm), http://www.sitebuilder3d.com/
- as plug in: Cosmo Player (CAI), http://www.cai.com/cosmo/

The study is very useful for deciding which software should be chosen in a specific planning case. .

In the here presented study different approaches in visualisation have been examined in order to determine their suitability for different planning purposes in landscape planning. A first orientation about the pros and cons of different approaches is given in table 2.

table 2: Application of Different Visualisation Tools in Landscape Planning

tool	**recommended application, purpose**	**strengths and weaknesses**						**preconditions**
	visualisation of	**realism**	**time/cost effort**	**GIS based *)**	**interactive, exploration of landscape**	**Internet **)**	**flexibility ***)**	
2D photos, orthogonal and perspective aerial photos	present state of a single viewpoint, illustration of before and after, e.g. of visual impacts of development	+ +	++ (changes uncomfortable)	- (location may be shown in GIS)	-	+	-	digital or analogue photographs, photo-rendering software
3D still images on the basis of GIS	diachronic comparison of landscape states from selected viewpoints, visualisation of small landscape parts where a realistic detailed image of the future situation is needed	+	+	+	-	+	++	GIS –map + digital data about landscape elements, visualisation software
image draping over a 3D representation of the terrain	aerial view of the landscape (supplement maps), 'before and after', close ups not possible	+ (aerial view)	++	-	(+) (only aerial view, limited functions)	+	-	elevation model, aerial photograph, graphics package for changes
virtual worlds (VRML)	aerial view as well as view of a pedestrian (supplement maps), major visual changes for small to medium sized parts of landscape; participation of local people to develop new landscape features	-	+	+	++	-/+ (if prefabricated scenes)	+	GIS-map+ digital data about landscape elements, elevation model, VRML software
3D visualisation on the base of photos (two-layer technique)	aerial view and close ups, close ups limited to small areas (2x2km); 'before and after'	++	+	-	(+)	++	(+) changing position of elements in the picture easily	high resolution aerial photograph, photo mapping of the site, software to turn 2D into 3D
videos	existing movements, processes, etc.	++	+	-	-	(+)	-	video film

*) landscape changes easily to follow up
**) small files (which run in reasonable time on home computer with modem)

Legend: ++ very good
+ good
- weakness

***) time needed for rendering changes, e.g. in meetings)

The following gives more detailed information about the different approaches.

6.3.3 Non-interactive still images

Photographs

If a combination with the GIS database does not offer increased efficiency or if there is no need for the user to explore different landscape changes, it is likely that a good aerial orthophoto[4] or terrestrial (digital) photograph will be more appropriate in many applications than a 3D or VRML visualisation. (see Bergen et al. 1995)
The research of Simpson et al. (1997) demonstrates that satisfying results can be achieved also in visualising future landscapes (policy on, policy off scenarios) with computer manipulation of photographic images, if the predicted change can be illustrated by a limited number of still images (Simpson et al. 1997).
It is also possible to take panoramic images and cross-reference the location of the photographs to a GIS (Evans, Hudson-Smith 2001:5). A tight coupling between GIS and the panorama or photo may be created by showing an arrow in the GIS to depict the direction you are looking in the panorama (fig. 5) (in Evans, Hudson-Smith 2001:5).

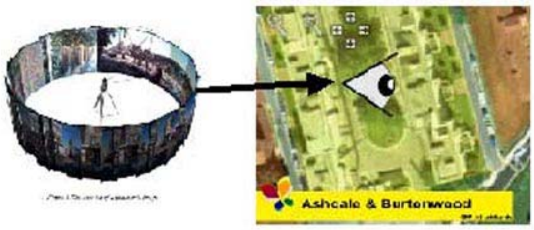

fig.5: Coupling between GIS/aerial photograph and panorama photograph (in Evans, Hudson-Smith, 2001:5)

GIS-based models for 3D still images (photorealistic rendering)

For a standard participation situation in landscape planning it might be totally sufficient to visualise different scenarios by still images but the combination with GIS offers a lot of advatages (see fig.6 and 7).

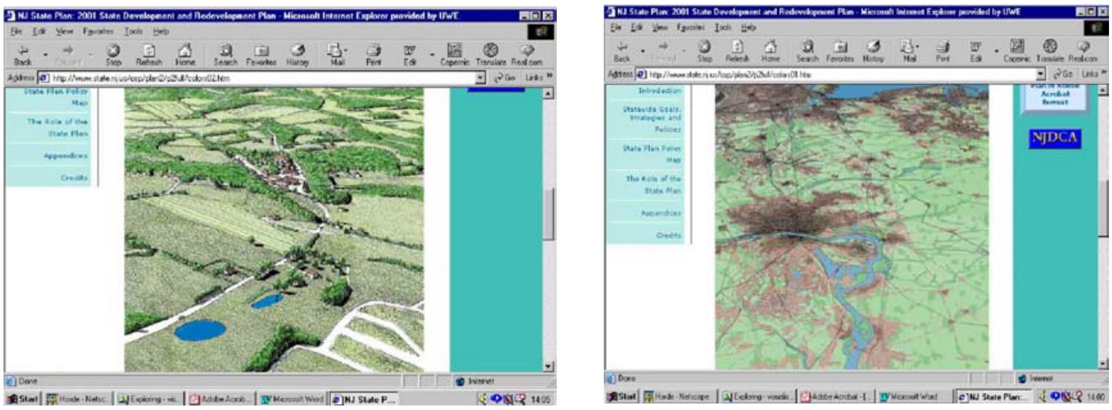

fig 6. New Jersey State Plan, Visualisation with In-house
http://www.state.nj.us/osp/plan2/p2full/colors01.htm

[4] . Orthophotographs are photographic images, which have been corrected to remove the effects of tilt and the topographic relief on the geometry of the photograph using photogrammetric software such as Erdas Orthomax (Miller, Wherrett 2000:4).

The best results in visualising still images, taking into account quality as well as time constraints, have been achieved with World Construction Set or even better with the new version Visual Nature Studio (VNS) (http://www.3dnature.com). This has been confirmed by our assessment of the software. But, the price of the software and the time required to master the program is considerable (Appleton et al. 2001). However the software seems well worth the higher price if it will be used frequently in a consultant office, e.g. for visualising impacts in environmental impact studies. The control over landscape elements, ease of working with GIS data and visually impressive results all seem to justify the higher costs (Appleton et al. 2001:7).
VNS is a complex, but highly capable programme with high quality photo-realistic rendering. It is more compatible with GIS than World Construction Set and therefore better suited to landscape visualisation. It easily imports Arc View shape files. Some data considerations should be taken into account, such as the need to convert line data into polygons (the master map has a polygon database) and the need to consider from the beginning what level of detail is required by the end user. Data features should be classified according to visual attributes in order to produce the visualisation efficiently. The software is suitable for representing data maps ranging in scale from 1:1250 (urban) to 1:2500 (rural) and higher. Data thus detailed is fully sufficient for all tasks occurring in landscape planning. Export in many format like iff or tiff is possible. The handling is not very easy but it is possible for the first time user (with other software experience) to produce a simple visualisation in a very short time (1 hour), if given an introduction.
The handling is as follows: textures are assigned to surface areas, which are delineated by polygon data. The textures are planar images imported in tiff format. Each polygon can be assigned an ecotype, for which vegetation height, density and type are designated. An ecotype editor is used to build a library of photos (trees with black background) for ecotype components (non-compressed format necessary). When the viewpoint is kept high, the terrain can be simplified and data size reduced. Foreground vegetation, surface texture and colour are important in making the scene appear realistic, whereas water and sky seem less important. (see example: fig.7).

fig.7: Comparison of Visualisation by a) Photo b) Still Image (World Construction Set Image) (http://enva2.env.uea.ac.uk/~e9071...rs/gisruk01/gisruk-tabs-figs.html)

Another technology to model landscapes at a regional scale which has not been examined in this paper, but seems to be well worth closer scrutiny, is the IMAGIS technology (Perrin et al. 2001). It is an interface that transforms landscape forms described in a GIS by 2D entities into much more elaborate objects in a 3D space. It is intended for use in creating broad landscape models, from which photo realistic images can be computed with a modelling workshop software called AMAP (Atelier de Modelisation de l'Architecture des Plantes). AMAP allows the user to generate and visualise a large number of plant models at various stages of growth (Perrin et al. 2001:33). This feature-class oriented approach of IMAGIS allows a lot of flexibility in rendering (Perrin et al. 2001:46).However IMAGIS does not have a logical data query function like a GIS would offer. Once the GIS database is transferred into IMAGIS, the analysing capabilities are lost.

6.3.4 Interactive models (image draping and virtual worlds)

Image draping

A simple way to create a 3D world in landscape planning is the combination of an elevation model (based on GIS and VRML) with aerial photography. Aerial photographs may be draped across Digital Elevation Models to provide input data for visualisation software which derive perspective views and allow viewing at different resolutions, scales and viewpoints. Sequences of views might be compiled into video fly-throughs (Miller,Wherrett 2000). Watkins (http://www.reading.ac.uk/~sgs98jtw98/wychwood.htm) uses the *3D Analyst* extension of the *ArcView* GIS to render a terrain from contour data and then drape a photographic overlay (scanned and geo-rectified aerial photography) over this model. The 3D Analyst software allows the user to alter the height exaggeration factor, the angle of view, the zoom extent, the light direction, and also to rotate the model. *ArcView* also offers the utility to drape map data and/or images over this terrain. To show how the landscape would have appeared 150 years earlier, the contemporary aerial photography was air-brushed in the *PaintShop Pro* graphics package. This involved the removal of buildings, the addition of woodland and the movement of hedgerows. Also Landscape Explorer 2000 (free for educational use), is a simple program that allows real time-movement of landscape with either a drape or colour shading.

Such visualisations do not require large amounts of information and rendering time is fast. They are very useful for showing an aerial view of the landscape. Visualisations of the present state of the landscape as well as future change can be easily created. Close ups are usually not possible with this technique because the resolution of the photographs, in most cases, limits the extent of enlargement. Pixels of the aerial photograph will become too large in a close up. But the effect of large changes in landscape can be presented well in this manner. For some applications, this can even be an advantage, for example when an increase in detail, content and realism may confuse the overall picture and complicate the decision making process (Miller, Wherrett 2000:15).

This way it is possible to explore these landscapes. More likely though is a use as still images for illustrative purposes (Appleton et al. 2001). Appleton et al. found, that the visual results of image draping were not really satisfactory with any of the three assessed software packages. In areas with more relief or where buildings appear, 3D Analyst seems to be most suitable in terms of facilities of the program, navigation, and output (Appleton et al. 2001)

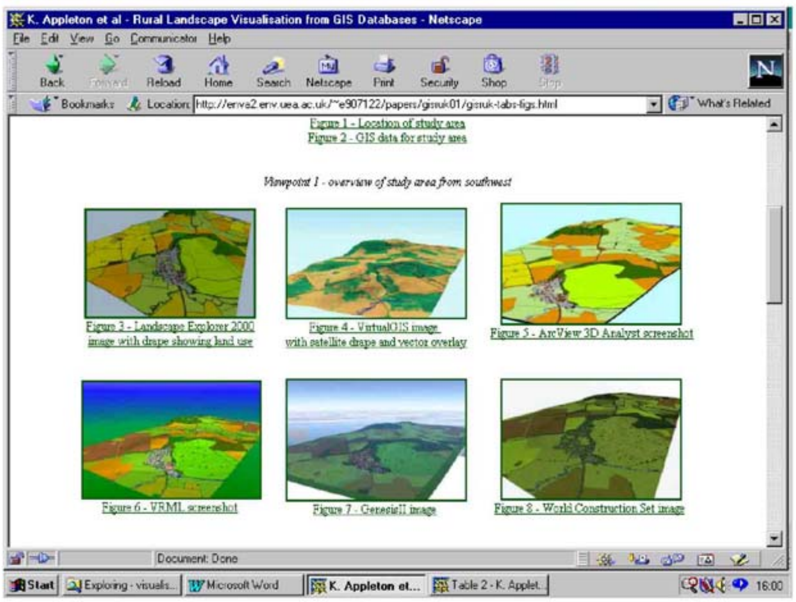

fig.8: Comparison of Visualisation by Several Software Packages with Draping Facilities (http://enva2.env.uea.ac.uk/~e9071...rs/gisruk01/gisruk-tabs-figs.html)

Virtual worlds

Other application require a close up view or even the perspective of a pedestrian in the landscape and more interactive facilities. In these cases VRML has to generate 3D objects like trees, buildings etc. to create a virtual world which may be explored by the user fully interactively.

VRML (Virtual Reality Modelling Language) is the present standard language for describing 3-dimensional worlds on the web. VRML objects can be linked to text or data or web pages. They can interact with each other, driven either by a virtual clock or by a user interaction (Huber 2001). A standard web browser equipped with any of many freely available "plug-ins" (such as Cortona under www.parallelgraphics.com) can be used as an interface into a 3D virtual reality and enable the user to navigate the system. This allows, as a result, the possibility of fly-over and real-time sequences and enables a synchronic exploration from any viewpoint of a landscape scene. Virtual Reality Models (VRML) of landscapes to date are still rather simple and give a rough impression, which is usually better as a map.

With a tight integration of GIS and VRML, it is also possible to link VRML to other data that may be interactively displayed, e.g. as associated with “frame on demand” web pages. Queries such as 'where is…?', 'where is the nearest…?', 'what has changed…?' can be answered. And the effects of a proposed change can be demonstrated visually and with other information (Counsell 1999:10,11).

The virtual world should be generated in such a way that the user recognises a familiar landscape element and gets an image of planned changes. This is not achieved easily by using VRML. The biggest problem in VRML landscape visualisation is the complexity of the objects. Landscapes consist of so many items that the image produced does not always give the viewer a satisfactory landscape impression, instead only a rather symbolic one. Better results may be achieved, but they require a lot of work and produce huge files. Significant landmarks or very specific landscape features in the foreground require a special time-consuming effort to model them precisely. In many cases such as the modelling of the visual effects of proposed building development or a reforestation, this may well be problematic. The disadvantage of additional data, staff time or computing resources required to create more realistic VRML models, might counterbalance the advantage of the easy and quick handling of the software (Appleton et al. 2001).

Therefore a lot of attention should be paid to the pros and cons of still images versus animated ones (Perrin et al. 2001:46):

1) Animated images are always very attractive, especially for the layperson. VRML models are suitable as a supplement for people who are not used to reading maps. But a trade off still exists between level of detail in computer images and the refresh rate. In order to provide real time performance and autonomous exploration, simplification is necessary to keep the model manageable (Bishop et al. 2002:5). Therefore, large-scale landscape changes can be shown with VRML, especially if the symbolic nature of the visualisation is pointed out and its purpose (what is this good for?) is stressed. Free navigation on the Internet is possible. And loading and running time both via the Internet and in presentations may be reduced considerably if predefined animated tours are provided. VRML models should therefore be confined to core areas where orientation is important and changes at a larger scale are planned. At a closer look, though, the rather simple models are often not what the user will expect and feedback shows the need for more realistic images (Appleton et al 2001).
2) In these cases still images might be a better option. Still images allow a diachronic comparison of landscape states from selected viewpoints and usually a better quality and more realistic image is produced because its rendering is not limited by real time constraints. Therefore Perrin et al. (2001:46) propose the use of still images primarily when the simulation of potential change is the objective.

Some spatial VRML models of cities and buildings are well known. (Los Angeles, London http://www.cs.ucl.ac.uk/staff/A.Steed/london-demo/vrst99/index.htm and Bath, Cathedral of Wells, Tower of London).The goal is to create a 3D-map as a public information tool. Links between objects in the model and data available on the Internet are possible. The Bath model (http://www.bath.ac.uk/casa/completed/views.htm) has been used for extensive communication (Bulmer 2001: 23). The model is provided over the Internet and a number of proposals for the future of the city can be shown.

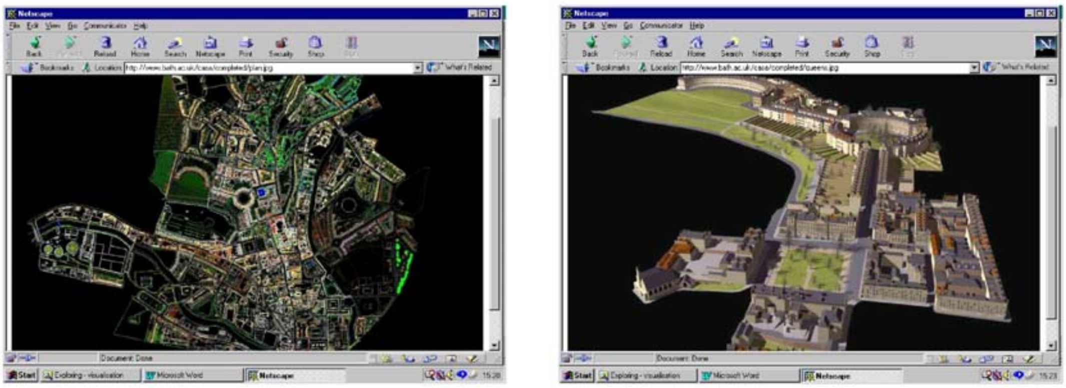

fig.9: Model Bath (http: http://www.bath.ac.uk/casa/completed/views.htm)

Examples of VRML models of virtual landscape may be found in the case studies in chapter 7 (Oxfordshire). However, it seems that there are not yet landscape models that are satisfactory in every respect, because the simplification of features, which is often necessary for interactivity, makes it harder for the end-user to orient themselves (see fig. 10:).

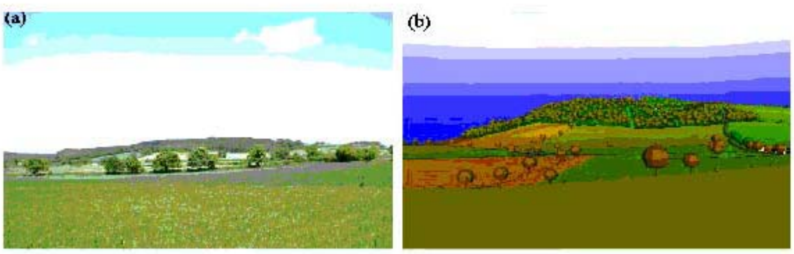

fig.10: Comparison between a) Photo, and b) VRML-Model (Appleton 2001) (http://enva2.env.uea.ac.uk/~e9071...rs/gisruk01/gisruk-tabs-figs.html)

Software

PAVAN

In this paper Pavan (VRML) was the only piece of software assessed due to the lack of other suitable tools and because it is recommended by researchers in Britain. It is also considered the most suitable software for the use of VRML in planning (Lovett p.c., Counsell, p.c.). Other software packages (like ArcView, IMAGE and GenesisII) will export 3D terrain models in VRML format but do not include other landscape features. There are other ways to produce VRML models (for example Site Builder 3D an extension of ArcView) that can cope with larger landscapes and more detail than PAVAN, but they require sophisticated high-level 3D visualisation systems and cannot be viewed on desktop PCs.

PAVAN seems to be effective for generating a VRML code from a GIS database and it is relatively simple to use (how to use Pavan see www.pavan.co.uk). The virtual performance can be run by an Internet explorer with free of charge "plug ins" (Cortona, COSMO player). The result is a scene that can be explored and navigated interactively. Viewpoint and zoom can be adjusted, although this process is somewhat awkward.

The easy handling makes VRML accessible to a wider range of users. Basically certain pieces of information chosen from the GIS are linked to certain attributes and compiled to create the visualisation. This process might be repeated several times as it is possible to change the attributes later and compile again. This also enables the user to visualise temporary results -a big advantage of the software in terms of flexibility. Even a live application in a meeting would be possible if scenarios are compiled in advance and only changes to these have to be compiled in the meeting. It has to be considered, that unclassified polygons must be classified to prevent holes in the landscape surface. This results in additional work. DTM can be draped with aerial photos. However, one cannot zoom in too close without disturbing pixel resolution. It is possible to import a CAD file or place links to other media like digital photos, videos etc. .Also hyperlinks can be inserted. The software provides only simplistic vegetation and simple colour and image texture, sky and water look very basic. and. A "library" of trees and buildings (textures) can be used, but it is not extensive. It is not yet possible to create woodland or forest easily. Unlike facilities in e.g. 3D Visual Nature Studio (see above), there is no possibility to add trees to a polygon with a user specific density (Appleton et al. 2001:8). The trees have to be compiled one after another in a prototype square (not bigger than $100m^2$) (Lovett p.c.). After this work is done, you may create a forest by copying this prototype. The high number of trees needed in a larger area will increase the file size considerably and make it less easily navigable. Vegetation models can also be built from 2D sprites (gif format), which remain orientated towards the viewer, or from an external VRML library. For example, AMAP (www.bionatics.com) generates trees in VRML format. The presentation of a reasonable site size (such as 2 x 4 km) is recommended by Lovett (p.c.), a size which should be sufficient for most purposes in landscape planning.

In its current standard form, Pavan is not especially suitable for visualising rural areas. With current technology, trade offs are inevitable between detail and interactivity. Although considerable results can be obtained (see fig.11).

fig.11: VRML-Model of Wells Cathedral (http://environment.uwe.ac.uk/virtual/cathedral/wells.htm)

Pavan does not solve the general problems of VRML in visualising trees, grass, and rural landscape. At present, it is not possible to simulate the movement of grass in a natural way or to create the complex surface needed to represent a meadow (Nadesda Brkljac, UWE 7/5/02 p.c.). The movement in the visualisation (grass moved by the wind), which in nature will always take place in an irregular way, will seem peculiar to the viewer. A more realistic image is achieved by adding more data, but this increases the file size. Bitmap textures, for example, would create big files that would hamper easy navigation. The time to load the model on a laptop at a public meeting or from the Internet becomes too long and is not acceptable for the public (time spans see in Lovett 2002).
At UWE researchers have created some plug ins, that increase the abilities of PAVAN considerably. These plug-ins cover

- **Promenade application**: This tool was developed to overcome the problem of using large MPEG files across a slow network. It creates the illusion of walking down avenues or corridors by progressively re-scaling images projected onto geometry in a VRML scene. The resource is packaged as a library of JavaScript routines.
- **Story-board implementation application**: This is a small set of utilities used to create smooth "fade up/fade down" transitions between different media types such as MPEG, AVI, Real-time and Promenades. The resource is packaged as a set of new VRML custom nodes.
- **Database to 3D scene connections**: This is an addition to the Pavan 3D system which allows objects in a 3D scene to send queries and retrieve data from a MS Access database on a web server. The resource is packaged as a MapInfo addition, written using MapBasic and a small library of JavaScript routines, which can be embedded in the VRML scene code.
- **Improved and advanced level of detail** to the previous version of Pavan
- **Facility of mapping textures on the horizontal surfaces and terrain** (N. Brkljac, UWE 8/02 p.c.).

A problem for the use of Pavan in Germany is the close link to Map Info GIS (which is here not as wide spread as in the UK). Therefore it is recommended, that the database should be transformed into Map Info before using Pavan. This results in the necessity of buying Map Info as well, if Pavan will be used.
In summary, Pavan has proved to be a valuable tool for certain applications, for example, giving the user a better orientation by an overview of a portion of the landscape and its changes. The abstract quality of the model lends itself to large scale planning issues and the presentation of scenarios or proposed alternatives. But also the modelling of small areas, especially where buildings are the main features, and an interactive exploration of the visual world is possible. Hyperlinks are important to connect the user of a landscape plan to additional information or details helpful in the discussion. The interactivity of changing viewpoints allows the user to feel more connected to the site. It seems to be worthwhile to continue to develop Pavan, especially by making it usable directly with GIS software which is more widespread in Germany, and by enhancing its ability to visualise vegetation. Also, a function that assigns a default surface for missing polygons should be added. And, VRML needs a connection to a map in order to improve orientation.

Obviously, it is not always necessary to use commercial software packages for the creation of 3D virtual models. Huber (2000) (http://www.directionsmag.com) criticises most 3D software applications such as ESRI's 3D Analyst, because the VRML output of these programs tend to be large and cumbersome, often unusable for web delivery. He proposes to create effective VRML representations, suitable for web delivery by using much simpler tools. With some guidance, a third grader was able to create a significant VRML world in an hour using only a text processor (quick tutorial: http://www.directionsmag.com).

The approach of Zlatanova (2001) might show new ways in terms of combining detailed information with high performance in real time commuting. She developed a 3D topological model (for an on-site outdoor application) used for pose determination and rendering of virtual objects. The developed system uses "cheap" details in term of line features to reduce the complexity of the model. The performance of the mappings in relational database drops below 6 seconds.
Other software packages that should be more closely explored are:
GeoVRML (Web3D Consortium), http://www.geovrml.org/
LParser (Laurens Lapre), http://www.xs4all.nl/~ljlapre/lparser.htm
MultiGen-Paradigm, http://www.multigen.com/
VirtualGIS (ERDAS), http://www.erdas.com/products/imagine_virtualgis.html
VRML (Web3D Consortium), http://www.vrml.org/

3D-Visualisation on the base of photos

At the University College London (UCL, CASA) new ways to achieve photorealism in interactive models have been developed by integrating some techniques applied by the computer gaming market in combination with different software packages (Evans, Hudson-smith 2001:8). The main purpose was to communicate interactive spatial information with a high degree of photorealism and small file sizes via the Internet. The new approach was based on the experience, that the customers wanted a high degree of realism in the visualisation. If you wanted to achieve that in a VRML model, the files get too big and reaction time of the model slows down. This makes communication over the Internet difficult or impossible (Hudson-Smith, p.c.18/07/02). The solutions used by CASA seem to be especially suitable for orientating the user (substitute for reading a map) and for the visualisation of existing and future landscape features in smaller scale landscape planning projects. The case of a project in Hackney, Woodberry (http://www.hackney.gov.uk/woodberry/) illustrates the approach that consists of different techniques.

fig.12 Two Layer Photography Technique (http://www.hackney.gov.uk/woodberry/)

The user gets an overall picture of the site by an aerial photograph (orthophoto) shown in a small scale, and thus not requiring lots of disk space. If a close up is required, the user may zoom into the picture and, for a moment, gets a very blurred image of the chosen sight (because the original photograph with low resolution is shown). But this image sharpens very fast to a high resolution close up of the site. This effect is achieved with a flash-based two-layer technique. The first layer (aerial overview) does not provide all the data that is needed for the high resolution close up. This is loaded only for the chosen sight and when it is needed.

It is possible to walk into certain scenes that are presented with more detail from a pedestrian's viewpoint (Hudson-Smith, p.c.18/07/02). In these individual regions 3-dimensional models of the buildings have been placed upon the orthophoto. Photos are used to derive the geometry and to give texture to the model. With the support of certain software, digital 2D photographs are turned into 3D images (suitable software for this step could be Canoma: http://www.metacreations.com/products/canoma/, though handling is difficult and time consuming). The shape of the building is derived with a relatively low polygon count, which makes the model very 'low bandwidth friendly' (Evans, Hudson-Smith 2001:8). The model can be divided up into individual objects, which can be made "non-fixed" to give the user the opportunity to move them around. This way different scenarios, which show diverse positioning of certain elements, can be created and viewed. This approach is very user-friendly and application can be navigated using a standard home based computer. The technique has been limited, though, to areas of approximately 2x2km, since the developing of larger models would be very time consuming. (Evans, Hudson-Smith 2001:9).

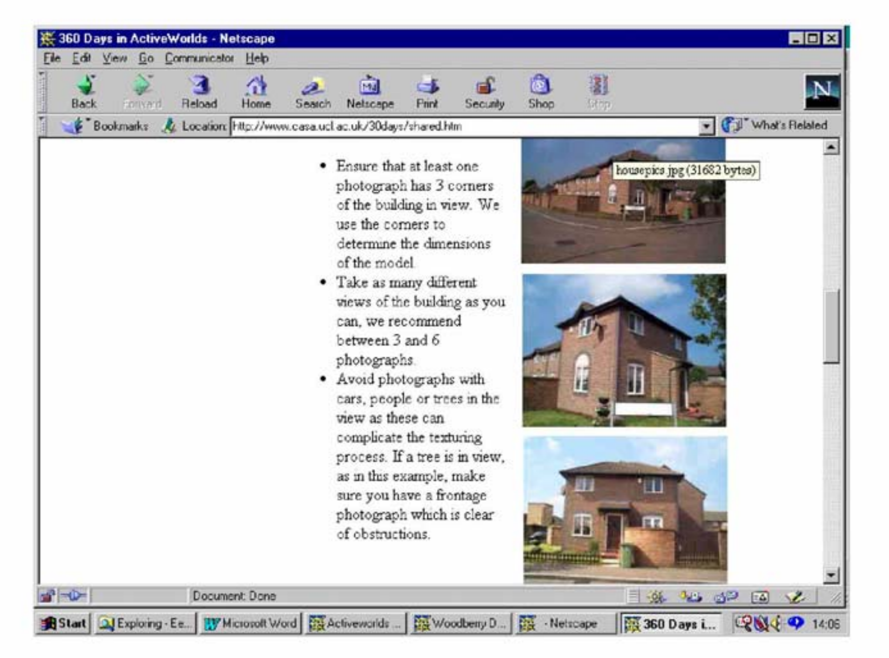

fig.13: Example: Preparation for 3 D Photo-Visualisation: 360 day in active world shared architecture http://www.casa.ucl.ac.uk/30days/shared.htm

This technique requires high-resolution aerial photography. The site must be thoroughly photo mapped, in order to show "close ups" from a pedestrian's viewpoint as well as roof-shapes and texture of buildings, trees etc. Each scene uses 32 photographs, taken from different viewpoints (Hudson-Smith, 18/07/02). The produced files are very small (around 100kb) and easily transferred over the Internet. The information transfer doesn't require more than a phoneline and a modem.
This technique enables the user to fly easily around the scene (more comfortable than in a VRML model). Without having defined the real heights of elements in the image, the user gains a sense of the location. The software Viewpoint (www.viewpoint.com) is recommended as a plug-in, because it supports an easy use of the system (also suitable: Rowley: http://www.nlm.nih.gov/research/visible/vhpconf98/AUTHORS/ROWLEY/ROWLEY.HTM; or in the case of landscape 3D visualisation shockwave is recommended: www.macromedia.com/shockwave/download/, Hudson-Smith, 18/07/02).

The underlying principle of loading only those bits of information that are currently used also is applied in the Active Worlds software (www.activeworlds.com) and several applications in real time collaborative planning techniques that also work over the Internet (http://www.casa.ucl.ac.uk/30days/). In a CVBDS (Collaborative Virtual Design Studio) developed by CASA (Smith 1998:38) the Active Worlds software is also used and supplemented by an Internet GIS and a WWW integrated database. The CVBDS also runs on home based personal computers and may be accessed via public or private machines. The user is able to walk around virtual representations of real world developments with the site developers, architects and planners, all represented as avatars. The production of identical scenarios allows each design team to view the work of others. Feed back from each session will be provided in the CVDS www-site (Smith 1998:40).

Other software packages than Pavan have been used in different applications and should be assessed in a future study more closely concerning their use in landscape planning. Obviously good visual results have been achieved with the following software packages in applications accessible over the Internet:

- CAVE Automatic Virtual Environment; example application: http://www.gis.uiuc.edu/hpgis/cave.htm
- Terra vision, examples: http://www.tvgeo.com/screenshots/bathy.shtml, http://www.state.nj.us/osp/; movies of live demonstrations of Terra Vision operating in real time: http://www.tvgeo.com/movies.shtml
- Polytrim, example: http://www.orl.arch.ethz.ch/~Lange/goldau/goldau.html (no use of VRML)
- OpenGL/C++, Virtual Forest:, example: http://www.innovativegis.com/basis/Vforest/default.htm
- SGI Performer, ex. Project: http://www.mluri.sari.ac.uk (no use of VRML)
- In-House (Open GL): http://www.geomatics.kth.se/patriko/visual.html (no use of VRML)

For more information about some of these project and other applications see http://www.casa.ucl.ac.uk/virgin.cat/project21.htm.

6.3.5 Different tools for augmented reality: integration of videos, real time videos, use of remote imaging techniques

Videos of the landscape or part of it may be easily integrated in any kind of presentation of an existing landscape and certain elements. Sequences of views of aerial photographs may be compiled into video-fly-throughs. The strength of this media is the animated picture, which will catch the attention of the user and the ability to create a tour of the landscape, viewing it from different locations. Whether the lack of flexibility offered to the user will be a problem depends on the intended use. However, there are several further limitations associated with the creation of the video sequences, including processing time and disk space. Miller and Wherrett give an example of a file they produced using aerial photographs for a fly through. This required 1.1Gigabytes of disk space for a nine minute sequence, at 15 frames per second, for viewing on a Silicon Graphics workstation, using panchromatic imagery and video compression of 75% of the original imagery (Miller, Wherrett 2000:16). Most of these issues are essentially hardware and software related and may be overcome in the near future (Miller, Wherrett 2000:16).
Another application of videos: The primary objective of the Valhalla Project is to digitally present historic gardens and landscape parks, on-site and on the Web (Counsell 2002:7). The purpose is to provide a site overview, not usually achievable at ground level, and to increase and to broaden public access and to facilitate improved public understanding of landscape history, design and culture. It is also the goal to enable the staff of historic gardens to exchange skills and knowledge by using real-time video and video conferencing. The project aims to superimpose or project hidden information onto the visible surface.

(http://www.uwe.ac.uk/fbe/cprc/). In this project photographs, videos, plant identification, prints, paintings and historic texts from the database are incorporated. GIS and a VRML models serve as an accurate 3-dimensional spatial reference system. In the Valhalla project recording digital data without its accurate spatial location was perceived as likely to offer no more than short-term benefits (Counsell 2002, p.c.). VRML helps to manage the model and enables the process of selecting and presenting appropriate information with images to the viewer (see fig.14:).

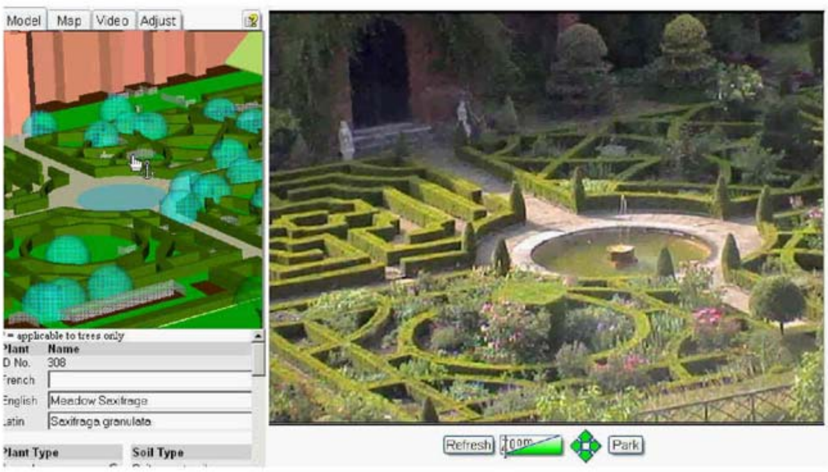

fig.14: Integration of a Map, a VRML Model and Real Time Video in the Valhalla Project; not shown in the figure is the also provided VRML Model (http://www.uwe.ac.uk/fbe/cprc/)

The user may access 'hot-spot' information (including real time video), that will be generated in matching VRML viewpoints from a 3D-spatial-information system. This involves a form of remote data capture, followed by spatial referencing and retrieval of digital images with other associated descriptive information (Counsell 2002:7, 8).

6.3.6 Sufficient level of realism in visualisations

It is still unclear what level of detail and realism is required for a user to recognise the presented landscape (or landscape parts, elements) and to accept the way it is presented. In general, the results of the research done by Appleton and Lovett (see chapter 7) indicate, that increasing detail improves results and does help people to relate to a visualisation and to imagine the landscape presented. Though the question of the 'adequate' level of realism is crucial for the effective use of visualisation tools, it has not been successfully answered up to now (Appleton, Lovett 2002, Lange 2001).
However, the results of recent pieces of research suggest, that not all elements of a visualised scene are of equal importance. It seems, that if certain elements are not simulated as well as or in a different style than others, this might cause a threshold of acceptance (Appleton, Lovett 2002). Foreground vegetation and the appearance of the ground surface over the whole scene obviously are of special importance. Therefore, effort should be directed towards improving the realism of the ground surface, including vegetation, especially in the foreground (Appleton, Lovett 2002:15). These are important hints for improving the visualisation of landscape scenes without aiming at the maximum possible level of detail.

7. Case studies and experiences of different research groups in the UK

Several research projects have been carried out or are being carried out in Britain at present, that deal with the development of different facets of e-enabled planning support systems. The most important of these projects have been examined in this study to learn about the effects of using different applications of methods, software and the design of more complex information and communication systems. Interviews were conducted with the scientists and sometimes also with the people involved as users, guided by the questions formulated in the introduction.

7.1 Case studies in Oxfordshire and Norfolk (experiences of the research group at the University of East Anglia, Norwich)

7.1.1 Research concept

The research of Andrew Lovett and others at the University of East Anglia, Norwich is focused especially on visualisations from GIS databases. However, this special topic is embedded in a broader approach to "whole–landscape planning" covering ecological and socio-economic aspects carried out in west Oxfordshire. The study area of this project covered 31 neighbouring farms (see Lovett et al. 2002:). A considerable part of the total study area (8,200 hectares) is owned by the National Trust (NT) (approximately 3,000 hectares). The NT was interested in a concept for the development of the farms and the reaction of the farmers towards it. Also, the prospect of inter-farm co-operation between adjacent farms was examined. Using comprehensive information about ecology as well as about the farmers' attitudes towards agri-environmental measures, conservation and sustainable agriculture, future scenarios of integrated whole-landscape management were developed. These scenarios were designed to deliver amenity, biodiversity and other environmental benefits. Scenario 1 represents business as usual, scenario 2 is focused on maximising visible landscape amenity, and scenario 3 was designed to deliver substantial nature conservation and biodiversity benefits. These scenarios were presented and interpreted to farmers and conservation stakeholders with the aid of GIS-based maps and 3-

dimensional virtual reality visualisations (Dolman et al. 2001:305). The decision to complement the 2D scenario maps by 3D visualisations was made because substantial alterations in the land cover were planned in each case. These 3D visualisations were carried out only for key regions within the study area (Lovett et al. 2002:112). Several types of visualisation software were investigated. An approach based on VRML was selected for various reasons including:

1. "ability to incorporate specific positioned features from a GIS database,
2. practicality of generating visualisations from within GIS,
3. platform independence,
4. potential for dissemination via the www,
5. ease of viewing with a standard www browser
6. limited software costs"

(Lovett et al. 2002:112).

One distinct advantage of VRML is the ability to navigate interactively through a virtual "world". A number of software tools were investigated for their suitability to create a VRML visualisation of the landscape scenarios. Finally Pavan TM software was chosen, because – compared with other software- it provided a lot of comprehensive VRML authoring tools for a reasonable price. Pavan TM is relatively fast, easy to handle and altogether seemed to represent the most efficient means of generating the 3D visualisation (Lovett 2002:116). These advantages counterbalanced the disadvantage that Pavan can only be operated with MapInfo TM.

7.1.2 Experiences

The study area includes the relatively flat landscape in the river Thames valley and a more undulating topography along the Midvale Ridge, which crosses the region from Highworth to Faringdon. In both landscape types, visualisations have been carried out (fig.6 and fig.9 show the landscape in a photo and, for comparison, as a VRML model fig.16 show a view to the Ashen Cops Farm and in comparison as a VNS visualisation. Also shown is Badbury Hill).

The complexity of a landscape as seen by a person who is focussing on different and also changing aspects of this landscape is very hard to catch in a visualisation, which should cover a variety of viewpoints. Therefore we probably have to accept that a very realistic image cannot be achieved (this is much easier with buildings). In the Oxford project the VRML visualisation has been kept quite simple, because otherwise the amount of work needed to achieve the visualisation would have risen considerably and complexity would have hampered the speed of the presentation in a public meeting. Basic features of the landscape, like elevation, settlements, single houses, trees, hedgerows and avenues, were visualised in a basic way using very simple shapes. No attempt was made to incorporate all the facilities available within VRML and Pavan (e.g. to depict a greater variety of vegetation types or add satellite imagery or aerial photographs to provide textures draped over the elevation surface (Lovett 2002:121, Lovett p.c.)). Pavan's particular shortcoming of being unable to utilise lines from an existing GIS database and convert them into 3D-objects, which created a problem in visualising hedgerows, has been solved in a very basic way. Instead of digitising the spine of such objects, which would have created a lot of work, thick lines were draped over the terrain surface to represent hedges and field margins. In the case of hedges, bushes were placed along the lines to give the structure a third dimension. The impression which the visualisation gives is more transparency than in the real landscape. To make narrow or small features such as field margins or buffer zones more visible or to emphasize new elements introduced into the landscape in the scenarios, bright but unnatural colours were given to these features (Lovett et al. 2002:119, and Lovett p.c.). The result is a 3D-landscape virtual reality that is not very realistic. It represents the landscape in a stylised and somewhat symbolic way. The advantage of this simple approach was the very short time to create the VRML model (depending on the size of the area included in the model from forty minutes for approximately one square-km down to twenty minutes for smaller areas, Lovett

2002:120). Once the model of the current landscape has been created, modifying it to create scenarios is simple and quickly done
The ability of the user to navigate through the virtual landscape by using the browser control has proved very useful in several demonstrations of the research (Lovett 2002:125). But Lovett also points out, that the speed of response to the controls was often rather slow. "Initial loading of the VRML model for the 2km by 4km area (Buscot House to Thames valley) took around 130 seconds on a 233 MHz Pentium II, with a further 25 seconds to shift from one viewpoint to another. For the smaller Badbury Hill model the time was a little shorter (Lovett et al. 2002:125). If accessed over the Internet, the time needed will be even longer. This suggests that moving at will around the models is possible but should not be the predominant method of presentation. For the purpose of audience presentation, it was found easiest to define at least six viewpoints and develop an animated tour in each model. Each tour could be left running for several minutes while members of the research team provided commentary on what was being shown (Lovett 2002:126).
The same method could be used to display 3D landscapes on the Internet. Freely navigable models that are accessible over the Internet should be kept rather small (cover smaller or less complex areas) and concentrated on the most important regions.

In terms of a realistic impression of the landscape, much better results than in the VRML model were achieved by using Visual Nature Studio for visualising still images (description see chapter 6.3). The software was chosen in the project, after examining several others. VNS is also based on a GIS model and is very quick (Appleton, p.c. 14.5.02). It is not cheap but seems to pay, especially if it is likely to be used often. The image of the Ashencops Farm in Oxfordshire shows a good example of a successful still image visualisation on the based on GIS (fig.17). Other examples of the same technique as a visualisation of the Coles River have been used for creating simple scenarios. In the meantime the National Trust has realised one of the scenarios: The river has been renaturalised the river, the banks are flattened and buffer zones have been converted to grassland.

fig.17: Ashencops Farm: Photo (v.Haaren) and VNS-Visualisation (by C. Appleton)

A skilled operator may create 3D images of landscape changes with Visual Nature Studio very quickly, e.g. even during a public meeting. It is possible to choose various viewpoints with still images and even to create a pre-defined walk. But, unlike the VRML model, it is not possible to navigate freely using VNS.

Reaction from stakeholders
In a meeting attended by representatives from thirteen stakeholder organisations (including local authorities, wildlife trusts, English Nature, the National Union of Farmers and the National Trust), reactions to the different visualisation methods were investigated (Lovett et

al. 2002:126). Also, interviews with farmers in the study area were carried out (Lovett p. c.). While the reaction to the maps was very positive (though the maps required careful study to detect the changes created by the scenarios), opinions on the VRML models were more mixed (Lovett 2002:126). They were considered to be attention-grabbing and potentially give an effective overview of the landscape. On the other hand, the farmers, in particular, thought that additional details and textures should be added to make the specific locations immediately recognisable by local residents. This impression was confirmed in individual interviews with farmers (Lovett, p.c., interview with proprietor Ashen Cops Farm 05/02). Other comments suggested improving the response speed or adding hyperlinks to individual photographs or legend information. In general the VRML model was not suggested as a substitute for conventional maps but as a complement to them (Lovett 2002:126).

Results of the research in Norwich about the „right level" of realism

The question of a sufficient level of realism is crucial for the effective use of visualisation tools. The realism of visualisation is dependent on the amount of detail in an image. To date, to create an image with a high degree of detail is on the one hand a question of the currently available technology. But on the other hand it greatly depends on the amount of data available in an appropriate form. However, the collection of data is expensive and a high degree of detail makes the visualisation slow and less easy to handle. For the efficient production of effective landscape visualisation it is, therefore, important to know what level of realism will satisfy the user. The reaction of users to the visualisation in the form of still images has therefore been more closely examined by Appleton (UEA Norwich) based on a visualisation of some landscape scenes in the Oxfordshire area (Appleton/Lovett 2002) and on a current planning proposal for a cycle and pedestrian path.

Three viewpoints in the Oxfordshire (eye level scenes) area were used to produce visualisations with a different level of detail in terms of

- ground surface (plain colour, procedural texture generated within the computer, image texture using an aerial photograph),
- foreground vegetation (absence/presence of plants such as grass and crops),
- building faces (plain colour, procedural texture, image texture using a perspective photograph),
- sky (absence or presence of clouds),
- water (absence or presence of ripples),
- shadows.

Sixty-two (62) participants (students, researchers and staff of the UEA) took part in the survey and were asked whether or not they could imagine real landscapes from the images shown. Each of them rated 30 pictures out of a sample of 50 (these had been chosen from 144 minimum possible variations and combinations of the above-mentioned elements in the pictures). The participants also compared some of the scenes with a photograph. As a result, only two elements were found to have a significant influence on ratings for all views: the presence of vegetation in the foreground and the type of ground surface cover. No other image elements had an effect across all views. While adding foreground vegetation resulted always in increasing the rating, the effect of adding ground cover varied more. It did not become clear whether procedural textures or photo ground cover were better accepted (Appleton, Lovett 2002:12) This suggests that further research is needed on this topic. Lange (2001) found that terrain with a draped orthophoto could be rated as highly realistic (compared with a photograph) in a long-distant view picture. In eye level scenes, aerial photographs did not get high ratings. A matching photograph had to be pasted into the model to get better results. Appleton et al. suggest, that consistently illuminated high-resolution aerial photography is needed if it is to be used successfully in ground-level visualisations, and that computer-generated texture could be equally or more effective. Referring to the research of Appleton and Lovett (2002), it might be interesting to mention that with respect to responses to specific factors, a familiarity with computer graphics led to higher ratings.

The visualisations of the cycle and pedestrian path (figure see http://www.uea.ac.uk/~e907122/research.html or http://www.uea.ac.uk/~e907122/ibg.html)

were designed for a general public consultation on the overall concept of the path, via a leaflet and a web-site, and to illustrate the proposal to current landowners along the route. Interviewees included planning officers, a landscape architect, a bridges officer, a highway officer and independent engineer, and a graphic designer from a council communications department. The following description of the perceptions of the visualisation by these participants is based on Appleton p.c. (05/2002) and Lovett (01/2002) (paper for conference in Belfast and Lovett, p. c.).
The main issue that was commented on in all interviews was the realism of the technique, and the question of whether a more realistic image should be aimed at. The examples shown to the interviewed people had a high degree of realism. It did not become absolutely clear whether high realism would be desirable for all visualisations. Some people thought that the images, especially the foreground, needed to be as detailed as possible to avoid confusion over parts of the visualisation. Others suggested that a high degree of realism might be a distraction because people would be discouraged from interacting and making their own proposals. A very realistic image might also fix certain details in people's minds which might be incidental. It was proposed, that *planned but not yet existing features* should be rendered in a different style from those that already exist on the site. Identical surfaces should be shown as identical to reduce confusion, but similarity should be reduced wherever that gives a better impression of the complexity of the landscape ("you don't want to imply that everything is just plain old grass and trees" (Lovett 2002, quoting interviewed landscape architect).

The subject of visualising uncertain, proposed objects also caused comments that suggested, that care should be taken not to obscure certain parts. People might lose trust in the images if they feel that something is being hidden. By the same token, not yet specified or optional, planned objects should not be absent from the visualisation. Ideally, parallel to different stages of the project and in different consultations, successive sets of images should be presented showing increasing levels of detail as the planning proceeds. Some elements, for example, might be left out at the beginning to give people the opportunity to fill in the blanks with their own imagination. In this case the visualisation is mainly used as a start for communication.
Some parts of the images do hold people's interest more than others. This may be at least partially governed by the realism and consistency of style among the elements of the image. Therefore these two factors should not be determined by random.
Participants agreed that there should be a map, aerial photograph or overview image showing the location and direction of viewpoints and the relation to the nearest familiar landmarks. The location of the images in the viewer's mind and their relation to the existing landscape is best achieved by showing the features that are visualised in a map or overview picture (e.g. a river, a village…). This overview can then act as a legend for the visualisation. For example, tarmac might be interpreted as water in the image; this could not happen if the overview connects the visualisation to a familiar landscape.
Different viewpoints of different groups of users (pedestrians, cyclists, boat users) should be taken into consideration, too, if a planning proposal is of relevance to all these users.
Since up to now the visualisation technique is not yet widely used, there is a need for additional information about the intended purpose, available options for various parts of the scheme and the data source. The latter serves the purpose of clarifying that the images are not primarily artistic but, nevertheless, a lot of parts of the image have a representational nature (e.g. proposed vegetation). The information may be given as a text or described orally during a consultation meeting.

Misuse of the visualisation in order to increase support for certain planning proposals seems more likely to be achieved through manipulation of the images in the visualisation rather than by increasing its realism.
The visualisation can be used in a "face to face" consultation process as well as via the Internet. Via the web, people could request certain viewpoints and these could be rendered

and put on the website. Also, additional information could be brought up by the viewer by clicking on certain elements of the image.
Compared to a photomontage, computer visualisations have greater flexibility in the choice of viewpoints and the ability to globally replace one set of objects with another. This allows scenarios to be produced more efficiently.

Suitable software
The research group in Norwich has assessed several software packages for the purpose of Image draping, creating photo realistic still images and Virtual Worlds *(*Appleton et al.2002). The results for image draping were not really satisfactory with any of the three software packages. Most suitable in terms of facilities of the program, navigation, and output if there are buildings or an area with more relief, seems to be given by 3D Analyst. The best results in visualising still images considering quality as well as the required time have been achieved with World Construction or even better with the new version Virtual Nature Studio. But the price of the software is not low and the time required to master the program has to be considered. To create a VRML model Pavan (VRML) was the only piece of software assessed, due to the lack of availability of other suitable tools. It proved to be an effective toolkit for generation VRML code from a GIS database and is relatively simple to use. This makes VRML accessible to a wider range of users. In its current form it is not especially suitable for visualising rural areas although satisfactory results can be obtained.

Conclusion
An important conclusion of the case study is, that there is no universal landscape visualisation solution (Appleton et al. 2002). The type of visualisation has to be carefully chosen, taking into account current technology options and the issue in hand, the resources and the end-users. Each type of output has its strength and weaknesses. With current technology, trade offs are inevitable in the areas of detail and interactivity.

Virtual Reality Models (VRML) of landscapes to date are still rather simple and give a rough impression better than a map. They are suitable as a supplement for people who are not used to reading maps. Large-scale landscape changes can be shown and free navigation on the Internet is possible. Both via the Internet and in presentations, predefined animated tours have proved most suitable, because they speed up the loading time and running of the system considerably. VRML models should be confined to core areas where changes of a larger scale are planned. The rather simple models are often not what the user will expect and feedback shows the need for more realistic images. To create more realistic VRML models though, additional data, staff time or computing resources are needed. But that could counterbalance the advantage of the software the easy and quick handling. Therefore the symbolic nature of the visualisation should be pointed out and its purpose (what is this good for?) should be stressed.

Visualising landscapes using still images gives a better opportunity than VRML to enhance the realism of the picture. In general, the results of the research done by Appleton and Lovett indicate, that increasing levels of detail do help people to relate to a visualisation and to imagine the landscape presented. (Appleton, Lovett 2002:15). The search for an ‘adequate’ level of realism has not been successful up to now (Appleton, Lovett 2002, Lange 2001). However, the results suggest, that not all elements of a visualised scene are of equal importance. It seems that if certain elements are not simulated as well as or in another style from others, this might create a threshold to acceptance. Foreground vegetation and the appearance of the ground surface over the whole scene obviously are of special importance. It therefore seems that effort should be directed towards improving the realism of the ground, including vegetation, especially the foreground (Appleton, Lovett 2002:15). These are important hints for improving the visualisation of landscape scenes without aiming at the maximum possible level of detail. The effect of adding real-world detail to the land surface in the form of draped aerial photography could not be determined clearly in the quoted

research. The benefit seems to be at best inconsistent, but the UEA researchers suggest that further research should be carried out on this topic.
The need for visualisation should be considered right at the beginning of a project, because it should be taken into account during the collection or collation of data. A pre-existing database is likely to need modification. Suitable data does not necessarily mean very detailed data. In particular, it is necessary to pay attention to the level of detail accepted by a visualisation package and the loss of information in the rendering process. In spite of the different needs of the software packages, generally it seems to be possible to create a master dataset from which the relevant information can be extracted (Appleton et al. 2002).

7.2. Case studies: "Shaping Slaithwaite" and "Yorkshire Dales National Park Reforestation"

The Centre for Computational Geography, University of Leeds, has been working on the development of support systems for public participation and especially participatory GIS (PPGIS) for several years. Their research focuses on the question of how to disseminate geographical information via the World Wide Web in order to allow the general public to query and manipulate information as well as to submit their ideas about spatial problems to decision makers. (Carver et al.1998a, Evans et al. 1999, Kingston et al. 1999).

Three web-based projects addressing these questions have been carried out recently by this research group: "Shaping Slaithwaite" is a very good example of a public participation scheme for town planning at a local scale. The Yorkshire Dales National Park Project is focused on the participation of tourists and local people in a reforestation project on a regional scale. Another project has been developed on a national level, allowing UK-wide participation in the development of a scheme for the disposal of the country's nuclear waste. While the first projects mentioned above directly tackle problems and conditions also relevant in German landscape planning, the national project is only remotely connected to these problems and will therefore only be referred to here if it contributes to the solution of certain, for example, technical problems.

7.2.1 Slaithwaite

The "Shaping Slaithwaite" system is an online PPGIS facility and was among the first of such systems available to the public, which allowed a two-way flow of information. Users of the system can –on the basis of a map of Slaithwaite– perform zoom and pan operations to assist in navigation, and get information to such questions as "What is this building?", "What is this road?" (see figs.18 and 19). In the next step they may make suggestions about the present state and the desired development of features identified from the map. It is also possible to read the comments of other users. In addition to the online facilities, a 3D model of Slaithwaite was made by schoolchildren, which could be used for orientation and to put stickers with their proposals into the different sites.

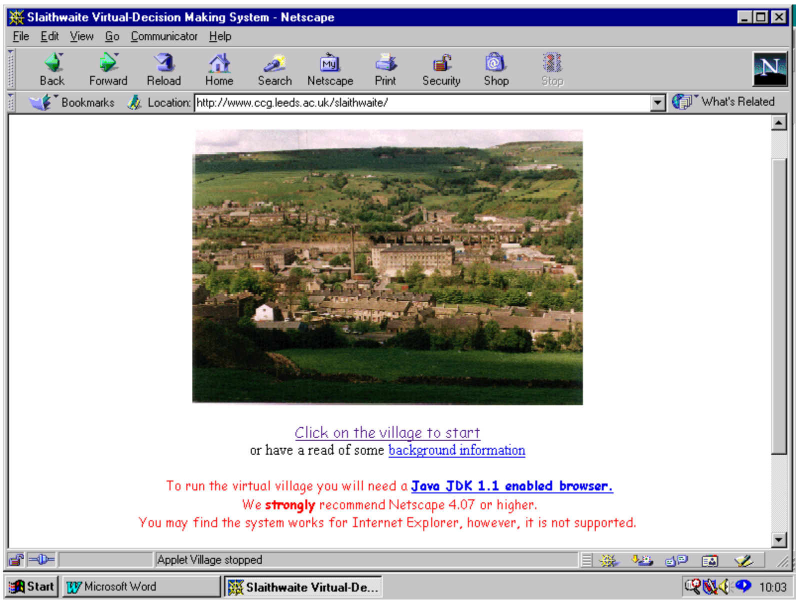

fig.18: Getting Information by Clicking on the Map (Slaithwaite)
http://www.ccg.leeds.ac.uk/slaithwaite)

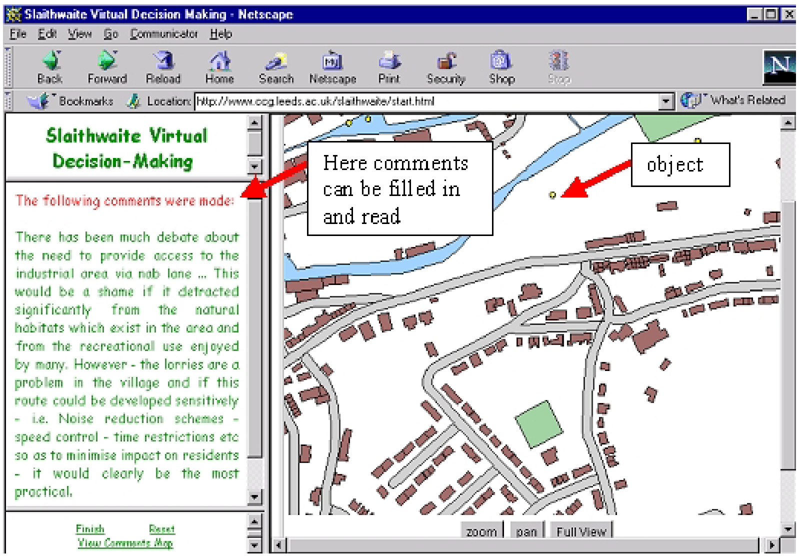

fig.19: Making and Reading Comments

All user input is stored in the Web access logs and is used for analysis and feedback into the planning process. In this manner, a community database has been created, representing a range of views about the planning issues under discussion (Kingston et al. 1999:3). Demographic information and information on the users' feelings about the system was also collected (see fig.20).

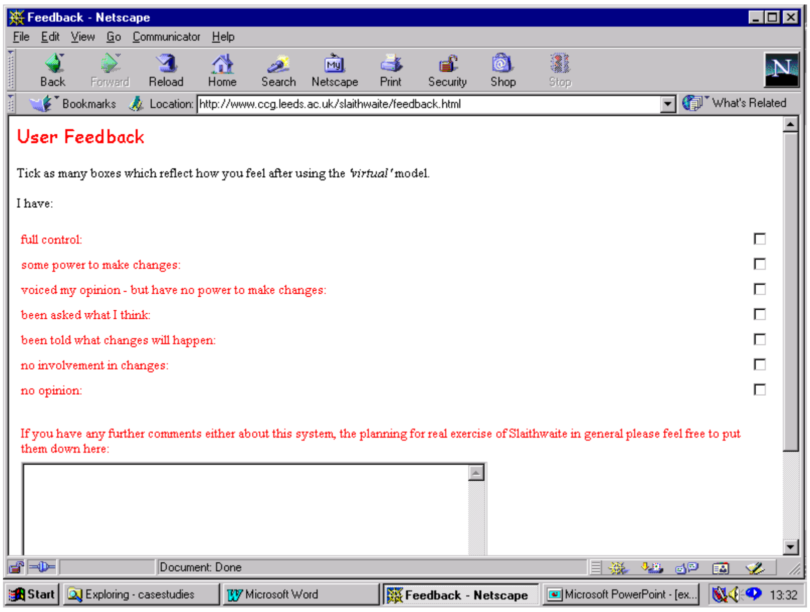

fig.20: Questionnaire

The system was implemented using the vector classes from "Geotools", a Java class package for the display and querying of ESRI shape files (www.geo-tools.com.org). The user responses were handled using perl server-side scripts and html forms.

Reaction of the users

The reaction of the users has been observerd by activists from the Colne Valley Trust (CVT, the institution that organised the event 'Shaping Slaithwaite' to get people's ideas about the development of the town) and by members from Leeds University. At the event 'Shaping Slaithwaite', the attitude of people towards using the computer could be watched. There were significantly more people, who used the solid 3D model (nearly 1,100 suggestions were placed on the model). Far fewer used the GIS, most of them teenage boys (Seanor, p.c. 12/8/02). Elderly people in particular, preferred the real model to the virtual map on the computer (Woolnough 26/06/02), but children were acting as pathfinders for the older people (Carver 25/06/02, Seanor 12/08/02). Typically, school children used the keyboards, while their parents or grandparents told them to work the system on their behalf. When one of the research staff was not available, the situation was very often rectified by younger members of the community, who either taught those experiencing difficulties or entered data for them (Carver et al. 2001 915). All users seemed to prefer the fact that they could type any amount of information on any subject into the comment area (Carver et al. 2001:916), which was a clear advantage over the real model, where the size of the papers on the sticks restricted the amount of information that could be written down.

It might be worth mentioning, that people who used the computer were much more willing to answer questions about the decision-making process (The solid model and the pc were used about the same amount to answer the questions, although the solid model had been frequented much more).

The reaction of the local authority to the event and the models was not enthusiastic, primarily because the structures or funding was not in place to proceed with many of the issues raised. Also the independent approach of the CVT might have meant that local councillors and officers did not identify with the initiative. Critical comments were made mostly that expectations were raised and little done (Seanor 12/08/02).

However, the CVT sees some important outcomes of the whole process such as:

- Colne Valley transport surveys contributed to a KMC Rural Transport Officer being employed;
- The health service produced a local health survey with community comments highlighted;
- Two initiatives, for developing local play areas and a community car share scheme, were developed.

Members of these groups state that they became active for the first time at the "Shaping Slaithwaite" event (Seanor 12/08/02). Seanor concludes, that both models promoted land based issues and citizen awareness of those problems. What was missing were issues that did not have a clear land based dimension like unemployment in the region.
Obviously for the long term success of such a process, it is important to have a success start in implementation, to communicate the outcomes clearly to the public and to have good contact and involvement with the local authorities and other organisations.

7.2.2 Yorkshire Dales National Park

A Woodland Online Decision System (WOODS) was set up for the Yorkshire Dales National Park Authority. The goal was to support decisions about the increase of "natural" woodland in the National Park over the next 25 years. The Authority had proposed an increase of woodland of 50%. The public participation of visitors and local residents of two communities should support decisions about where new woodland was to be planted. To involve these groups, a web-based decision-making environment has been developed (see fig.21) with a GIS in the centre, that allows the public to model a number of possible planing scenarios (Evans et al. 1999:6).

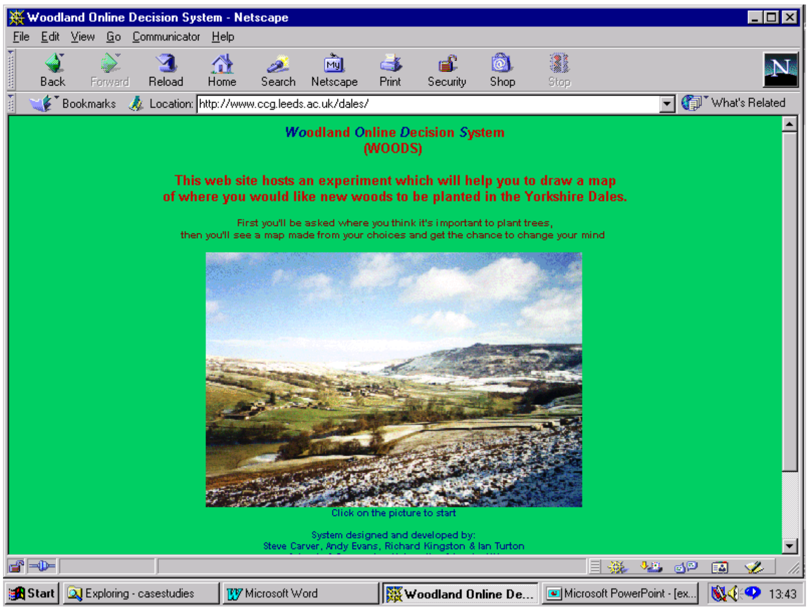

fig.21: Start Page of WOODS

Users are made familiar with factors and constraints that influence decisions about where to plant new woodland (textbox). On the basis of maps that show the area covered by each factor (fig.22) users are encouraged to decide whether they consider a certain factor favourable or unfavourable to the planting of new woodland. In deciding about each factor step by step, the user creates a map of his individually preferred woodland planting areas (fig.23).

textbox:

The factors and constraints that you can consider in making your decisions on where to plant are:

Environmentally Sensitive Areas
Limestone pavements
National Nature Reserves
Sites of Special Scientific Interest
Existing woodland
Meadows
Lowland pasture
Dales moorland
Areas of Bracken
Nearness to a river
Nearness to a road
Nearness to existing woodland
Dale sides
Gill sides

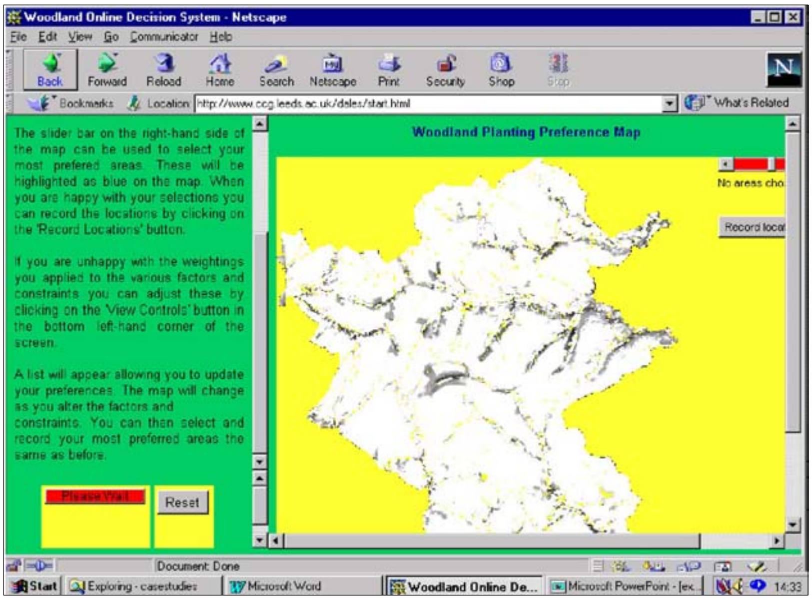

fig.22: Asking for User Preferences Concerning the Above Mentioned Factors

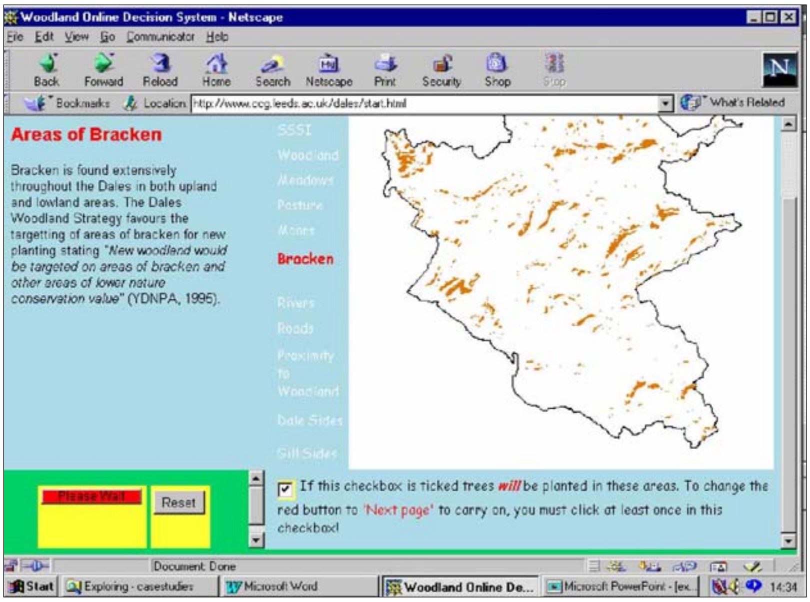

fig.23: Result: Individual Woodland-Preferences of the User

At the same time the users are allowed to browse in-depth information that is provided through a tree hierarchy, with more detailed information on each subject further down the tree. This tree system was designed to encourage the exploration of information until a level is reached with which the user feels comfortable. The user decisions are collected and integrated to a composite decision map that shows the degree of user agreement (up to 95%) in different shades/colours.

The composite decision map clarifies the general agreement among participants that woodland should be concentrated on the steeper grounds of the Dales sites. This result is in line with the areas suggested by the Yorkshire Dales National Park Authority

Experiences, users' reactions

Users' reactions in using the computer (Carver et al. 2001) in the case of the woodland regeneration website are similar to observations made in the Slaithwaite study. The data about the age and occupation of the users of the website showed very clearly that schoolchildren predominated, followed by well-educated professionals, students or academics (Carver et al. 2001:914, 915). During a live testing at the Yorkshire Dales National Park visitor centre it could again be observed that there was a considerable amount of people, especially those from older age groups, who were not familiar with the use of computers and, for example, had never used a mouse before. A much smaller number of people had difficulties in understanding the map itself (Carver 2001:917).
The advantage of using the decision support system for the National Park authority consisted mainly in making transparent the criteria of decisions about where to regenerate woodland, as well as giving the opportunity for users to actively comprehend the step by step decision-making process (Carver 25/06/02).

Clive Kirkbride (20/8/02) and other staff from the Yorkshire Dales National Park Authority got the impression that the system needs to be more user-friendly for a better support of decision-making and to enhance the acceptability of reforestation in the public. There should be, in particular, better means of visualising the planned changes. In detail they expressed the following points:

- The general reaction from the public seemed to be one of curiosity about the novel use of the technology rather than what the decision support system was actually trying to achieve.
- People did not seem to be scared of the technology. But the recollection is that many of them found that the programme was not as user-friendly as it could have been and that the maps were a bit difficult to understand. Thus, for widespread use as a decision support system, interactive computer programmes must be as easy to use as they can be. (Staff at the Park, who could be expected to be more familiar with the technology than most members of the general public still have difficulty in using a GIS system that has been available since the mid-1990s, despite the fact that the park administration employed consultants last year to design and install a user-friendly interface.)

If the programme were to be used to influence attitudes towards reforestation, the programme would have needed to be far more realistic with photo visuals showing "before" and "after" situations based on people's choices (using digital photos rather than computer-generated models). With something as subjective as reforestation in sensitive landscapes, such as National Parks, the technology needs to be a lot more sophisticated in terms of visualisation on the one hand and very simple to use on the other, if computer aided participation is going to make a real contribution to the way decisions are influenced and made.

Consequently, the project has not influenced the NPA's decisions about where to reforest. The NPA has a woodland strategy, a local biodiversity action plan and a recent landscape character assessment report which are the main policy tools for supporting decisions about the location of new planting. The woodland strategy and the LBAP, in particular, are very positive about new planting in the Dales and both contain ambitious woodland creation targets. Between Jan 01 and March 02 approximately 180 ha of new woodland were created in the National Park (Kirkbride e-mail communication 20.8.02).

Also Carver and Kingston (p.c. 25/06/2002) stress that the user interface needs to be presented in a way that takes into consideration different levels of computer-literacy and also different interests in the subject matter as well as different levels of education. Therefore, they suggest a tree-shaped information model, that provides more detailed information the further down the user goes into the system. Another approach to identify the e-literacy of the user is to trace, through a special program, the user's movements on the screen and to lead the user to a kind of interface appropriate to his abilities in using the computer.

Only if this really user-friendly interface is achieved, will the"silent majority", who might be the majority of people affected, but who prefer not to give their opinion in public meetings, get a much better chance to participate by using the web. The computer offers them the opportunity to give their opinion anonymously.

7.3 Case study Sherwood Forest – University of Nottingham

The University of Nottingham (School of Geography, R. Haines-Young, J. Rubiano) has been developing a decision support tool for the management of the Sherwood Natural Area. The Forestry Commission funded and supported the project. The general objective of the research is to use ideas from environmental accounting and valuation, and give additional attention to human actions through the use of soft system methodologies. Thus the different ideas and opinions of stakeholders and the public should be integrated into the decision-making process. Landscape analysis in this understanding must go further than merely analysing the physical world. It must include the general values of society and the special values and perceptions of local users.

The project has been presented on the web (see http://www.nottingham.ac.uk/~lgxjer/) but was not laid out as a participatory GIS. The information has been processed with the support of a GIS and several digital maps have been generated, but most of the consultation was real life consultation using aerial photographs or printed maps as a basis for face to face discussion.
Especially interesting and relevant for interactive landscape planning is the approach of Haines-Young and Rubiano to tackling the task of how to capture people's views on how the landscape should look like. The aim was to create "Vision Maps" that storyboard the visions that people keep of the countryside they are living in. Another useful approach for participation in landscape planning is the methodology of capturing stakeholders' views on the general situation and special problems (see Rubiano 2002).

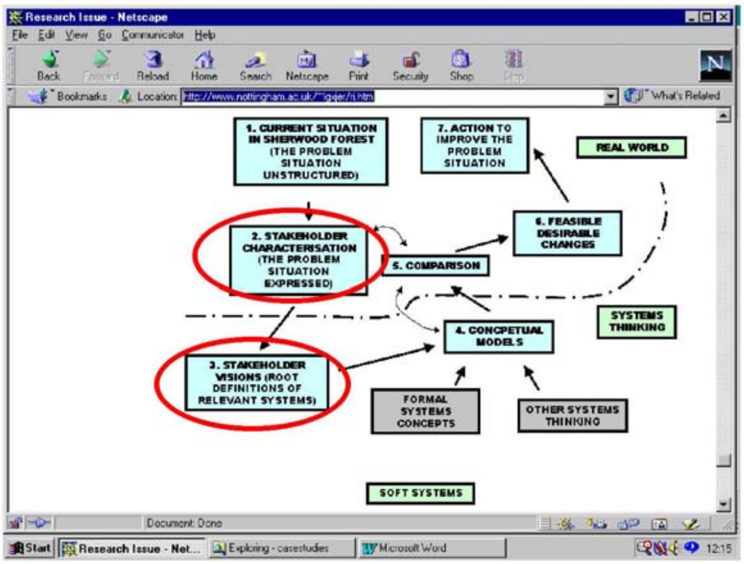

fig.24: The Seven Stages in the Use of Soft Systems (changed) (Rubiano http://www.nottingham.ac.uk/~lgxjer/ri.htm)

Tools for capturing stakeholders' 5 views are taken from the stakeholder analysis methodology used in the area of business administration and management (see Grimble, Wellard 1997 in Rubiano 2002). Stakeholder analysis is a procedure for improving the understanding of a system through the identification of the key actors or stakeholders and the impact or changes that their interest can generate (Rubiano http://www.nottingham.ac.uk/~lgxjer/).

The ideas of the different stakeholders about desirable landscape changes were captured in the Sherwood project by making stakeholders put pins into those sites of the landscape of which they would like to have more of in a future landscape. They also were encouraged to make comments about the reasons why they chose those sites. As a basis for this process, an aerial photograph was used in public meetings (Haines-Young, pc 24/06/02). The experience of Rubiano in this project was that people had much more difficulty in reading maps than in interpreting an aerial photograph.

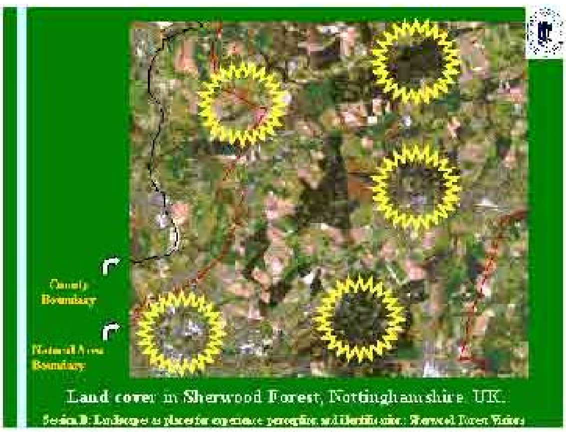

fig.25: Types of Landcover in Sherwood Forest

[5] Grimble et al. (1997:175) relates the stakeholder term to a group of people, whether "organised or unorganised, who share a common interest or stake in a particular issue or system". The term may equally include abstract categories such as "future generation" (in Rubiano http://www.nottingham.ac.uk/~lgxjer/)

A GIS was used for finding other sites that represented the main features of those chosen by the participants. The result was a map that showed in a transparent way the vision spaces of different groups of stakeholders. There was a high level of agreement, though, between participants about which areas are typical for Sherwood Forest and consequently which should be increased (Haines-Young 25/06/02).

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