Landscape planning and visualisation -World Construction @ Frankfurt -

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1 SPATIAL PLANNING AND PLANNING COMMUNICATION

At the climax of the discussion about co-operative planning procedures prominent experts stated that spatial planning – thus also the landscape planning – is more an interdisciplinary, co-ordinating and communicative activity than a technical discipline (Koschitz 1993, p. 31). Although meanwhile also acknowledged in planning practice, this predicate confronts planners with some – at first sight not obvious – problems. In the first paragraph this article therefore deals with the fundamental aspects: Participants, information and communication as well as visualisation in the context of planning communication. The basis of this text is a report to the EU-Project "Sustainable Open Space" (SOS).

1.1 Participants, Persons involved

Central participant of the statutory function of "landscape planning" remains the municipality or the entrusted planner. In order to be able to execute functions within the area of the landscape planning competently, this participant usually completed a study of a planning-relevant subject, which qualifies her/him for the adequate execution of landscape planning functions. The landscape planner is "expert" in the fulfilment of functions as well as in the application of a technique for information transfer, which is regarded with priority in this article. Communication between these landscape designers, acting in different positions, and experts in other authorities, which represented in former times the standard of planning communication, usually take place in the context of learnt procedures and under use of specific means of communication. The use of these means of communication was learned in the course of professional training and is characteristic for the experts. This qualification is usually not limited to the perception and decoding e.g. of planning maps, but includes also the ability to produce presentations of planning by using visualisation techniques themselves. Beyond that the experts represent either the interests of their client or are at least – e.g. by the advice of a municipality – assigned to find a solution of the planning problem in the course of the planning process.

Likewise a specific interest characterises another group of participants called "active people affected by the planning" by Koschitz/Arras (Koschitz/Arras 1990, p. 35ff). Here, the span of the involvement can reach from the affection of a legal position up to an involvement which results from a topic-referred commitment e.g. in an agricultural union. The motivation to bring own interests into the planning process increases the information and communication requirement of this group on the one hand, and on the other the group strives for an information basis to strengthen its own position. The independent development of a database and its evaluation represent a possibility to cope against the "information monopoly" of the experts. Another possibility exists in using the information available on the experts side. If these are accessible, mostly the readiness exists to undertake the necessary information decoding steps for strengthening the own position e.g. by learning the plan symbols. Only by this possibility of taking up information independently the chance arises to influence the planning process on the basis of a founded own position.

This activity or the readiness to learn expert-specific means of communication can not be expected regarding the third group of participants, which is the so called "passive public". Although Hill emphasises that "strengthening the democratic infrastructure" is a substantial effect of participation and communication in planning procedures (Hill 1993, p. 976), a special effort is necessary to achieve these effects on a broader base. This effort essentially consists of a *completely recipient-specific editing of planning information*. This means that the expert must consider the interpretation repertoire of this group of participants, which is shaped by mass media (Bechmann 1981, p. 94). Koschitz/Arras call this communication area "planning marketing", whose target is to inform and motivate the passive public (Figure 1).

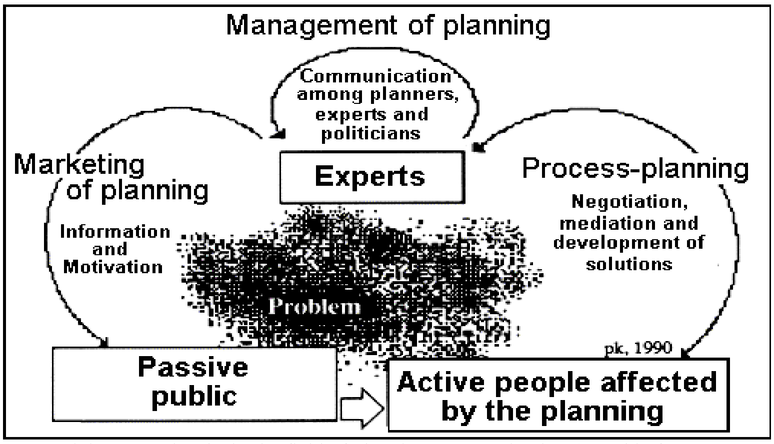

Figure 1: Participants and tasks in the field of planning communication (Koschitz/Arras 1990, p. 36)

Although the shown classification has some weak points, it becomes clear that in the context of this article the regarded application of techniques for communication must consider different situations. Thus it is not amazing that Koschitz states: "more than a technical discipline spatial planning nowadays is considered to be an interdisciplinary, co-ordinative and communicative activity". This surely also applies to landscape planning.

1.2 Information and communication

Taking a closer look, some important special features of information become obvious. On the one hand it becomes clear that the majority of so-called information, which is spread daily e.g. by the mass media, is in fact to be classified as data, since in a multiplicity of cases no purpose reference of the recipients is present. On the other hand it becomes clear that the use of an identical database, e.g. a planning data bank, can lead to different information, which depend upon the focus of the investigation The existence of a purpose reference is crucial in both cases regarded. This purpose reference results in each case from an evaluation which has to be made by the recipient. Only after a positive check of data in regard to its relevance to a current problem, information will develop on the side of the recipient.

The mandatory existence of an evaluation step however leads to a situation which can be classified as critical, *because it makes clear that there cannot be "objective information" in any way* (Coyne et al. 1996, p. 517).

Thus a substantial prerequisite of successful communication is – independently of the acceptance of the transmitted contents – an adjustment towards the recipient-specific abilities to take up information. These abilities to take up signals or, more exactly, the complete set of usable characters, can be described as the character set of the recipient. Therefore the expert's function is to present the information according to the character set of the recipient (Figure 2).

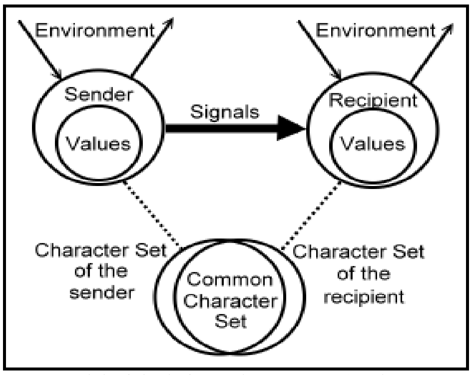

Figure 2: Model of the information process (Junius 1987, p. 2)

It is obvious that a recipient-specific editing of information on the one hand is a substantial amount of additional work for the expert because he has to develop different forms of information, and on the other hand this expenditure offers no warranty for successful communication, since the character set available to the respective recipient as well as the recipient's interpretation is not group specific but individual and thus can not be known for all cases. The equal information of all recipients would actually presuppose identical basic conditions on the receivers side. The cause that these identical basic conditions cannot exist, lies – as Flusser and Boehme-Dürr et al. explain – mainly in the emergence process of information of a recipient. Flusser describes the process of the information production as follows: "Information is produced, if preceding information stored in memories is interconnected" (Flusser 1995, p. 16).

This means that e.g. in a citizen assembly or a discussion with farmers or politicians, a lecture of an expert quite probably produces different information among the recipients (Siddans 1985, p. 282). An option to master this problem is the self-determined information accommodation by the participants. This option however presupposes an edited database offering a high degree of possible interaction (interactivity). Another option exists in the avoidance of participant-specific coding. In order to inform the participants of planning practice well, the expert should select a form of information coding which can be decoded by as many participants as possible on the one hand and which illustrates the planning object as clear as possible on the other hand. Since both aspects are essentially determined by the information the other participants already have, the crucial question to be asked above all is the question concerning the recipient-specific character set, the one which is relevant in the context of the landscape planning. Engelkamp/Zimmer assign the attributes used with high priority in this context, namely form, spatial configuration, size and orientation, to the visual system (Engelkamp/Zimmer 1990, p. 96).

1.3 Visualisation

Independently of the participant structure the long lasting use of visualisation techniques for information purposes in spatial planning results primarily from the fact that geographical or topographic features can be illustrated only insufficiently by numeric or verbal descriptions (Meise/Volwahsen 1980, p. 21). Keeping the specificity of illustration however offers further important advantages in the context of planning. Among other things the graphic illustration of planning information permits a simultaneous presentation of feature developments in a planning and on this base the easy derivation of planning predicates (Meise/Volwahsen 1980, p. 41; Daniel 1992, p. 261). Beyond that a linkage of several features, including their developments, which can be registered at once, is possible. In this way it is possible to illustrate sections of a complex reality, to put these sections in relation and to register them quickly.

Nevertheless difficulties remain which are mainly based on the contrast between the perception of humans aligned to the recognition of a complex environment and the abstractness of presentations implemented by maps. These difficulties become particularly clear in the participation of active people concerned by the planning or the passive public. Both Schrader/Pomaska, and Streich therefore demand additional representation forms, like an integration also of the third dimension into the visualisation of planning (Schrader/Pomaska 1983, p. 284f; Streich 1984, p. 486ff). However the integration of a three-dimensional representation into a planning visualisation does not ensure that all participants get the same information. In order to achieve clarity despite of different interpretation repertoires of different participants it is necessary to implement another approach, which considers fundamental aspects of information and communication. First conclusions, which founded an appropriate approach in landscape planning, were drawn by Zube et al. in the year 1987, by determining: „For centuries it appears to have been assumed that a drawing-is a drawing-is a drawing, and that it probably means the same thing to all who view it. The evidence is sparse and scattered but it does suggest that this assumption is invalid.“ (Zube et al. 1987, p. 76)

The question how to achieve the aim that all participants get the same information is answered by Espace & Strategy with their declaration of intent that an image as realistic as possible had to be created (Espace & Strategie 1991, p. 60). Robertson calls this approach "natural scene paradigm of visualisation" (Robertson 1991, in Bishop 1991, p. 61), the validity of which has been proved in the meantime by different investigations (Oh 1993, p. 214f). *Based on these findings it becomes clear that a realistic, not abstracting representation of planning which aligns itself to the foreknowledge of all participants, based on realistic representation, represents the optimal solution to communicate planning.*

Driven by advances in the digital data processing in the last years new potentials arose which can also be used within the area of planning communication in the addressed sense. Considering the background of modified habits of viewing of the entire society and thus also the respective communication partners (Buhmann 1994, p. 31; Sinz 1993, p. I)., the competence to evaluate visualisation techniques in regard to their possible support for planning communication is crucial. This competence is to be formed on expert's side, since he usually intends the use of visualisation techniques in order to reach specific targets (Neumann 1994, p. 18).

The choice of available visualisation techniques covers "traditional" as well as computer-assisted techniques. While the application of traditional techniques is mostly standard, the computer-assisted "New Tools" have been established in planning practice only in the last few years. Because the application of traditional techniques in planning processes – as shown above in detail – can only be successful to a very small extent, it was a target of "Pilot 1 – New Tools of Awareness" in the context of the SOS project to evaluate products and their applicability in landscape planning.

2 NEW TOOLS

It is obvious that usual means of communication (in particular maps of all kinds) only offer a very insufficient response to the modified communication conditions in planning processes. Therefore it has been one element of the SOS project to identify solutions addressing this problem and testing these on concrete examples.

2.1 Software

On the other hand expensive special solutions should be avoided. These "New Tools of Awareness" should consist of a combination of specialised software and standard hardware. Additionally, the ability to transport the products of these applications should incorporate traditional ways of communication as well as transport by the new media (World Wide Web, CD-ROM, video). Beyond, there must be the option to integrate available data from geographical information systems (GIS) in order to keep the additional collection expenditure as small as possible. This means concretely that:

- the software has to produce photo-realistic results;
- the software should be executable on Windows computers;
- the costs of the software must fit into a regular budget.

The search for relevant technologies which additionally integrate the use of space-referred data led very quickly to the result that it must be a kind of software which implements the "Image based Rendering" technique. Although there are very advanced techniques for the production of e.g. realistic looking plants available – in particular with very expensive special software for high-performance computers – this purely constructional approach is only in comparatively small extent usable on standard PC's so far. In order to reduce the high cost of necessary computation, the "Image-based Rendering"-approach relies on photographs to visualise real situations. This technique is therefore in particular of great importance in the area of the landscape planning, because here – in contrast to town planning – predominantly organic forms have to be modelled at a high expenditure. The use of digitised photographs or also in individual cases of designed 3D-Objects enables a drastic reduction of production time.

2.2 Quicktime VR

The most prominent representative of this software technology is surely Quicktime VR. This Tool, which is based on the Multimedia platform Quicktime of Apple Inc., enables – among other things – the production of virtual panoramas from a sequence of photographs which can be presented with an appropriate software. With the all-round visibility the user can choose freely to zoom in, or maybe move on into connected panoramas.

Basis of this technique are digital photographs, which were either made with a digital or conventional camera. If a conventional camera was used, it is possible to order digital pictures on CD rather than printouts. With a special authoring software these digital photographs (images) are assembled in a first step (Image Stitching, Figure 3).

Figure 3: Image Stitching (Screenshot Image Assembler)

In a second step the resulting picture must be converted into Quicktime VR format, in order to be able to regard it as a panorama. Figure 4 demonstrates this transformation. Usually no further intervention of the user is necessary.

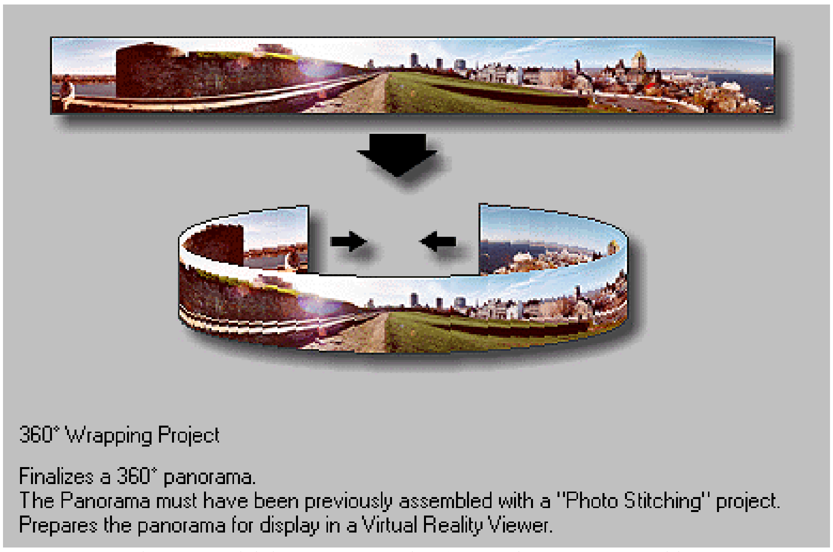

Figure 4: Quicktime VR conversion (Screenshot Image Assembler)

The result of this production can then be viewed off-line (e.g. on CD) as well as online (WWW) if Quicktime Multimedia software has been installed beforehand. This software is available free of charge and exists as an independent playing program for PC and Apple computer and as well as a Browser Plugin for the Internet Explorer and Netscape Communicator.

The costs for Authoring software range from US$ 69 up to US$ 300 and are therefore situated in the usual range for Multimedia software. Additionally the presence of a picture manipulation software is helpful, whose costs do not have to exceed US$ 300. This software can be used without problems on standard computers. Additional hardware is not necessary – apart from a camera.

This "Tool" is in particular suitable for daily application in landscape planning, since both the data acquisition (photography), and the production of panoramas can be integrated into the daily work of a landscape planner. A large training in the use of this Tools is not necessary due to the small number of required procedures. Only the additional application of picture manipulation software could require a more intensive study of the manual.

In order to produce panoramas that show visualisations of future landscape areas (e.g. after the implementation of development measures), the availability of picture manipulation software is mandatory, since in this case photographs and calculated renderings of the future status are mixed. The resulting overlay then becomes – as described above – after the assembly with other photographs, a Quicktime VR panorama.

2.3 World Construction Set

The World Construction set of the company 3d Nature is a representative of a type of software which is called "landscape visualisation program". Although various providers offering a lot of different products exist in this software category, the World Construction Set is suitable in a special way to fulfill the requirements of landscape planning.

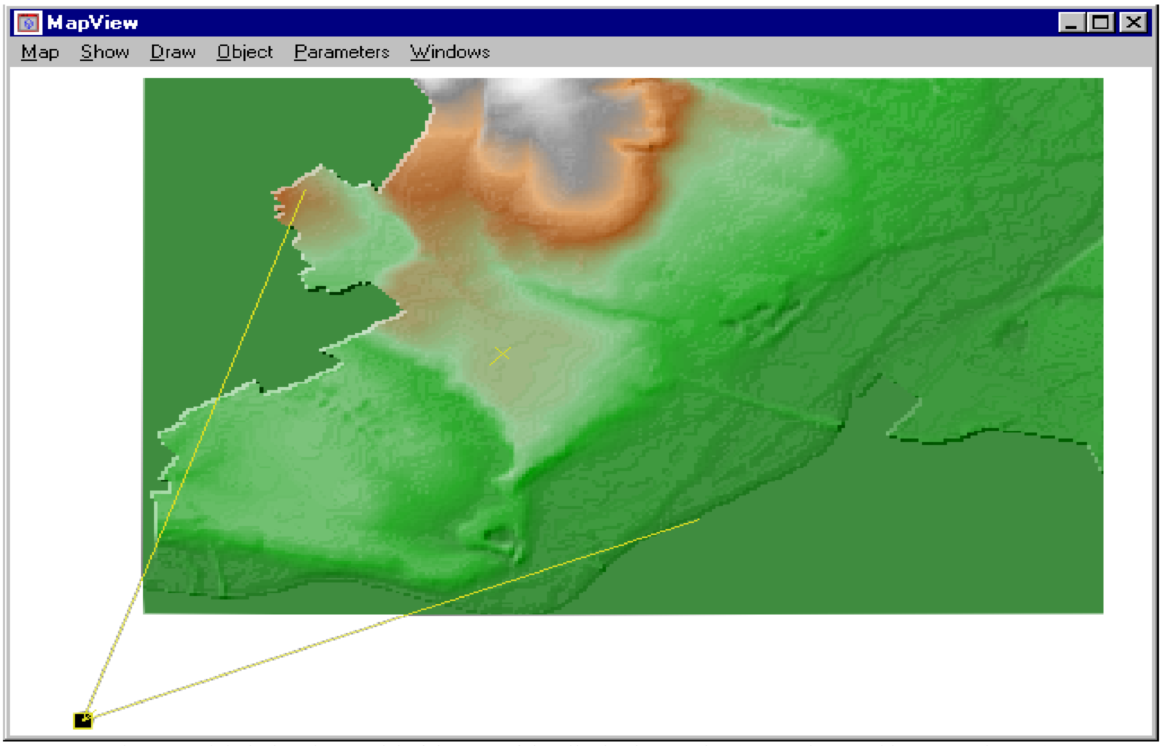

Figure 5: Digital Elevation Model of the area of the pilot landscape plan (Screenshot World Construction Set)

The price of US$ 940 is clearly settled above the costs of standard software, but the program offers – also in comparison to other visualisation programs – some special features which justify the investment. On the one hand a substantial advantage of the World Construction Set is in the support of the “de facto -standard" for spatial data, the "Shapefile format" of Arcview. But the support of spatial data does not only include this format, but also all other usual raster formats, which are used to describe digital elevation models (DEM). Among others DEMs of the United States Geological Survey and Arcview ASCII Grids can be processed. These digital elevation models form the basis of a World Construction Set (WCS) scene. Figure 5 shows the DEM of the pilot landscape plan area of the Umlandverband Frankfurt including a virtual camera (lower left), which permits a perspective view of the digital elevation model.

The general structure of a DEM consists of elevation data specified in a tabular structure, which – complemented with some spatial data – has usually the following form (Figure 6):

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hoehe-exp.asc

nrows          198
xllcorner      0.0
yllcorner      0.0
cellsize       50
NODATA_value   80
80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80
80 80 80 80 229 237 254 265 271 273 272 270 267 264 260 253 249 246 244
240 238 235 230 228 230 236 247 255 261 264 268 271 275 278 280 283 284
123 124 124 124 124 124 123 123 124 124 124 123 122 123 124 124 124 123
123 122 121 120 119 118 118 118 117 114 111 110 110 109 109 109 109 110
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Figure 6: Structure of a Digital Elevation Model (Screenshot)

On the basis of this land model additional spatial data (e.g. digital aerial photographs with a spatial reference) can be illustrated. A resulting perspective view is shown in Figure 7.

Figure 7: Aerial photographs draped onto a Digital Elevation Model (Screenshot)

It is possible to produce photo-realistic views of the planning area, if additional digital spatial data which characterises the existing ecological and land use structure is available e.g. from a geographical information system (GIS). This is achieved by assigning scanned photographs of appropriate plants to the ecological data of the GIS. The resulting view is shown in Figure 8. Beyond that, the integration of clouds as well as other atmospheric effects and any three-dimensional objects is possible. Combined with the comprehensive capabilities for animation, these integrated objects lift the illustration of the planning content on an attractive level, one that that meets the natural kind of seeing.

Figure 8: Visualisation of ecological data (Screenshot)

These advanced possibilities of presentation can, however, only be implemented by using a digital communication medium. In this context printouts on paper are to be regarded rather as by-products, which however have also their authorisation, since a direct interactivity is up to now not possible with the production of photo-realistic views on standard PC's. Thus the benefit of a dynamic information acquisition determined by the viewer exists at present to a limited extent only.

Both the World Construction Set and the Quicktime VR that was explained first are nevertheless valuable "New Tools of Awareness". With the application of these tools the possibility arises to present planning in an up-to-date way. As a result information is created among all recipients even if they cannot be counted to the set of experts.

3 PREREQUISITES

Based on recent research, the main problem concerning the application of the "New Tools" can be found in two areas. On the one hand the use of specialised application software like the World Construction Set is not easy to learn. On the other hand the extent and the quality of the available spatial data determine considerably the collection expenditure in the preparation of a visualisation and thus the height of resulting costs and the possible quality of visualisation.

3.1 Training

To illustrate the complexity of the World Construction Set – which is to be classified as very high in contrast to the "Tool" Quicktime VR – the following figure shows a screen-shot of the program.

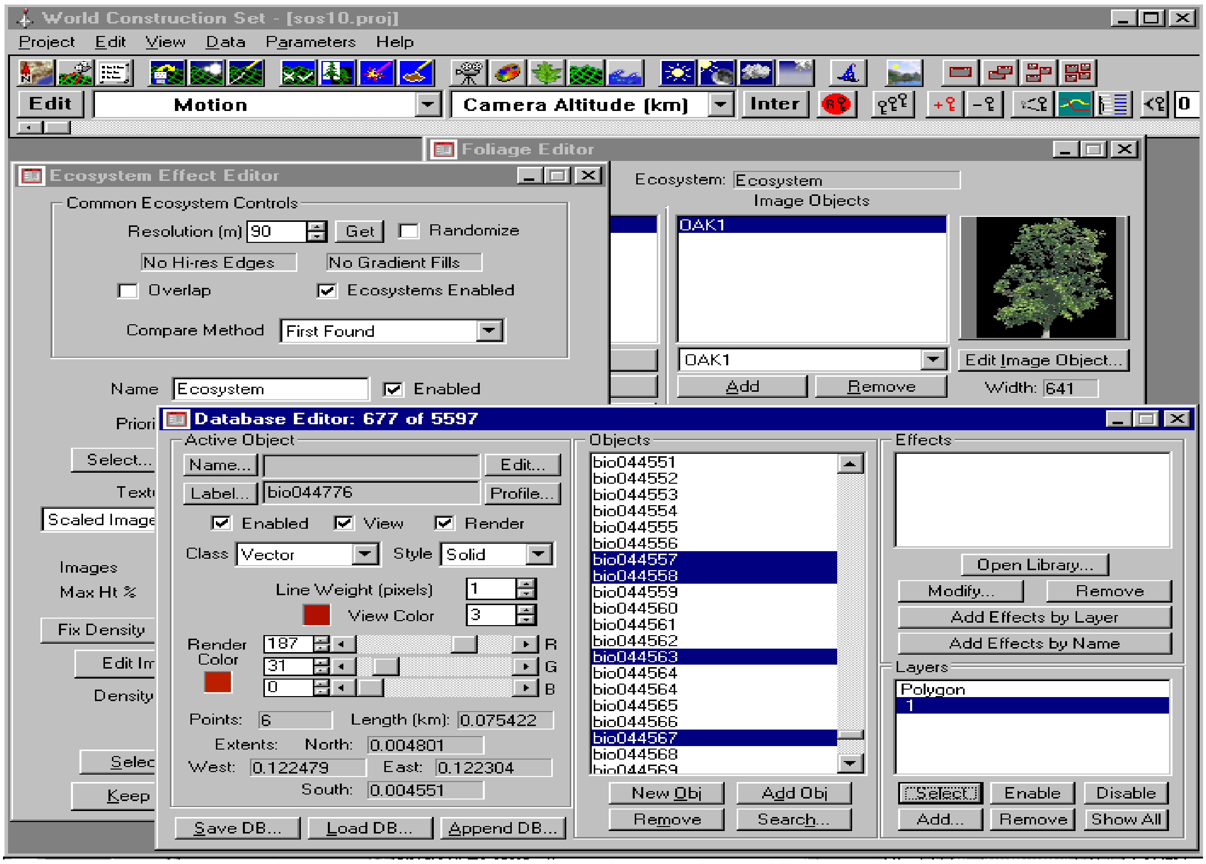

Figure 9: World Construction Set at work (Screenshot World Construction Set)

It is obvious that even the operation of the program requires an intensive training, and although a committed mailing list exists in the World Wide Web even learning the necessary basic skills is not trivial. Knowledge from the area of Geographical Information Systems and from the area of Computer Graphic and Animation is very helpful but in combination rather rare to find. Training courses or on-line courses for the mentioned topic only exist in form of tutorials, which offer at least a first entrance into specific problem solutions. The topics handled there however mostly don't cover directly the field of landscape planning.

3.2 Availability of spatial data

On the other hand the availability of digital spatial data, especially ecological and land use data, is not standard at landscape planning authorities. Even in the year 2000 the very good volume of data of the Umlandverband Frankfurt might be rather an exception. The complete integration of the relevant data in a geographical information system for the entire planning area might be, likewise, almost singular (Figure 10). This figure shows the general structure of a spatial data base, in which the columns of the table represent the features of the spatial data and the lines a spatial item in each case. The contents of the fields show thus the status of the individual feature in the respective area.

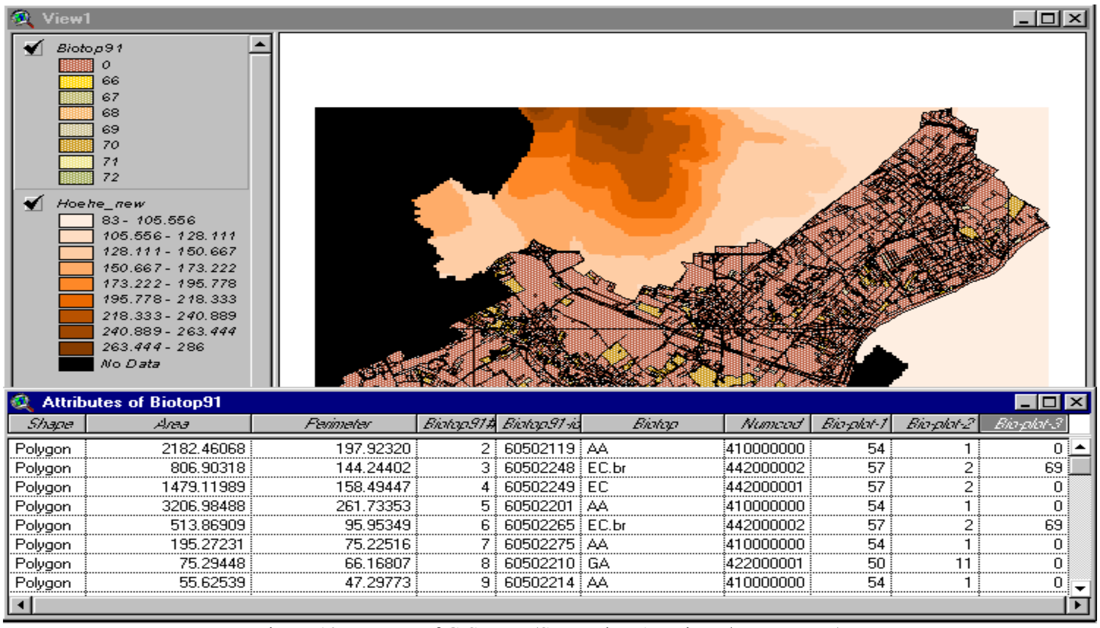

Figure 10: Excerpt of GIS-Data (Screenshot ArcView / Data: UVF)

But even the data available for the area of the pilot landscape plan are only partly sufficient for visualisation. For example the widths of the ways in the regional park are missing in the digital volume of data. A differentiated representation of the appearance of various ecosystems is likewise not constantly available, since this is of little importance for the daily work of the landscape planner. Thus the question remains, which possibilities exist to close this "gap" or which strategies are appropriate to handle this information deficit.

4 REQUIRED FURTHER RESEARCH

The problems specified in chapter 3 lead to substantial research questions which describe the further action required in the field of planning communication in landscape planning. The questions that have to be clarified urgently in the near future are among others:

- What is the minimum standard of spatial data in the context of landscape planning?
- How can we achieve this minimum standard economically?
- Do possibilities exist to use available volumes of data (e.g. from the remote sensing)?
- Are there (in future) supporting Tools which facilitate either the work with the complex programs or the production of "Low Level" but acceptable results?

The aim of this research should be the development of a modular conception for the application of the "New Tools of Awareness" which allows an appropriate reaction to different situations in terms of data availability or qualification of the personnel at landscape planning authorities.

Under methodical aspects the selected combination of the creation of relevant knowledge and the application of the “Tools” on a concrete case of planning implemented in Pilot 1 is very suitable to produce practice-relevant results. The design of the investigation worked satisfactorily, because only this combination guarantees that the findings can be used in planning practice and contribute to the creation of a lasting protection of open spaces.

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