WEB-BASED PLANNING SUPPORT SYSTEM FOR PUBLIC PARTICIPATION: AN INDIVIDUAL’S PERSPECTIVE

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1. INTRODUCTION

The Web-based Planning Support System (WPSS) has the potential to facilitate public participation in environmental planning. Currently the research in this field tends to concentrate on the operation and refinement of the planning process, the underlying assumption being that by improving visualization, interactivity, accessibility and communication between users, the GI technology (Internet, GIS, VR) can help overcome obstacles that prevent the public, especially laypersons, from being involved in environmental planning.

Even though the WPSS projects reported in the literature have not dealt with the rationales behind this involvement, they have been concerned - whether implicitly or explicitly - with communitarian thinking. That is to say, they have concentrated on the community and the rights associated with securing its collective well-being. This thinking is expressed very well in the discussion on the accountability issue faced by the WPSS [1,2]. Namely, how to ensure that the opinions expressed are a true representation of the whole community rather then those of small special interest groups.

Safeguarding community interests, including protection from interest groups, is undoubtedly important, but what about the individual’s basic rights to safeguard his or her own interests? It is well-known that self-interest is one of the main underlying motivations for public participation in environmental planning [3], including those who participate through the Internet [4]. Case studies of WPSS undertaken by Carver et al. [5] have shown that “spatial scale can have a significant effect on the manner in which the public responds to a particular decision ... People are very interested in those decisions that pertain to their area and thus affect them directly” [5, p. 918].

The main aim of this paper is to show how the individual’s perspective could be incorporated in the development of WPSS for public participation and to discuss the methodological implications. In the following section, I present a WPSS that integrates Internet-VR-GIS, developed in consideration of the individual’s perspective in the context of green spaces planning in Tel Aviv. In the last section, I will discuss the implications on the planning process and on the technological components of WPSS.

2. DESIGNING WPSS ACCORDING TO THE INDIVIDUAL’S PERSPECTIVE

The specific aim of the WPSS designed for public participation in the project of green spaces planning in Tel Aviv is to give residents information on their own house’s visibility of and accessibility to green spaces, and to be aware of planning actions that may have implications on that accessibility and visibility. This project is a prototype model for a comprehensive WPSS, established in ESLab (Environmental Simulation Laboratory) at Tel Aviv University, to inform Israeli urban residents on current and planned environmental
issues that have direct implications on their residential building and immediate environment (www.eslab.tau.ac.il). The methodological framework for the construction of such a WPSS is based on the four main components of the Planning Support System (PSS), suggested in previous studies [6,7]: model, data, geovisualization and access.

2.1 The Model: Accessibility to green spaces in a city

There are two criteria acceptable for allocation of urban green spaces (or urban parks) in Israeli cities [8]: Each individual needs to be in proximity of a park within a maximum walking distance of 250 m.; secondly, the individual is entitled to a sufficient amount of green – at least 7 sqm per person. Traditionally, accessibility is determined simply by the ratio of population size to the amount of green space in a given area (mostly at the neighbourhood level). Alternatively, according the same criteria, we suggest an accessibility measurement method for each building in a city. This measurements can formulated as follows:

\[ A_i = \frac{\sum D_i}{n} \]

\[ D_i = \frac{S_i}{Q_k} \]

where, \( A_i \) is the accessibility of building \( i \) \((i = 1...m)\) to green spaces within walking distance range \( k \) \((m denotes the number of buildings in the whole area)\); \( D_i \) denotes the potential population density in the park \((j = 1...n)\) that can serve the building \( i \); \( S_i \) denotes the park size and \( Q_k \) signifies population size located around \( pj \) within walking distance range \( k \). Using the method as a tool for planning purposes, the green spaces in a given area, let’s say a neighbourhood, can be evaluated according to aggregated accessibility values of the buildings in that area:

\[ D_L = \frac{\sum Q_i A_i}{Q_L} \]

Where, \( D_L \) is the average amount of green space per person in a given area, computed according to the average accessibility values of buildings in area \( L \) concerning the building population size \( Q_i \) and the area population size \( Q_L \).

2.2 The database and computation of accessibility

The urban infrastructure data required for implementation of the individual-based measurements method are retrieved from three databases: streets (street segments between junctions); buildings (polygons of buildings foundations) and parks (polygons of the parks boundaries). According to these GIS layers, a buffer in range \( k \) (the current range is 250 m) is computed for each park in a city. After the buffers have been determined, the density of potential users is computed for each park \( D_i \) using the park size area \( S_i \) and the population size \( Q_j \) based on detailed georeferenced household data of the Israeli Census of Population and Housing for 1995. In the GIS framework, personal and household records are linked to a polygon representing the house, and so population size in each building can be calculated - \( Q_i \). The last stage is the computation of accessibility for each building – the amount of green space per person. The distribution of the accessibility to green spaces in Yaffo (south Tel Aviv) is presented in figure 1. With this information, residents can know if their house is within a range of 250m and if they have a sufficient amount of green space i.e. at least 7 sqm per person.
2.3 3D Visualization: VR-GIS

3D visualization enables a clearer understanding of current and potential landscapes [7] and plays a key role in improving communication of information [9,10]. However specifically for the green spaces project, 3D visualization is a necessary tool for evaluating the current and planned visibility of green spaces from a certain building. For this purpose a Web-based virtual model of Tel Aviv was constructed by Skyline® software. This software integrates DTMs (or DEMs) and GIS features such as roads and houses to generate a geographically detailed virtual environment that enables the end user to walk through or fly over specific terrain. The virtual model of the city of Tel Aviv is constructed from the following components: DTM in a resolution of 50 m grid; Digital othophoto at a resolution of 0.8m pixel, and GIS layers, including building height, street network and green space. After the virtual model has been created, the information on the accessibility to green spaces, which is constructed by Arc View GIS software, is imported into the VR as a shape file. It is worth noting, that the main disadvantage of Skyline is the limitation of vector data that can be integrated into the virtual model. The problem is not so much with thematic maps but with vector data of building polygons that can be located on the orthophoto; According to our experiments, the Skyline system becomes very sensitive beyond 50 buildings. Figure 2 illustrates the integration of GIS layers into the virtual model of Tel Aviv and the possibility to see green spaces from a certain building.

![Fig. 1 Distribution of accessibility of buildings to green spaces in Tel Aviv. Includes non-served buildings.](image-url)
Fig. 2 virtual model of Tel Aviv integrated with GIS layers. Accessibility degree to urban parks within the virtual model of Tel-Aviv (left). Visibility of green spaces from a certain building in Tel Aviv (right).

2.4 Access: Internet-VR-GIS

The Skyline® software provides a platform to access the constructed VR-GIS through the Internet. This is the main advantage over other software for building 3D virtual environments, such as MultiGen-Paradigm. This technology also differs from 3D VRML, which aims to integrate VR-GIS through the Internet [11], mainly due to the streaming technology. In Skyline® software, the streaming works seamlessly across variable bandwidths on the Internet and is not affected by delays or breaks in connection. Once the user has received the initial scene in low-resolution, he or she is able to enter the 3D environment without waiting for entire frames of data to be displayed. The client-server model has been optimized to handle thousands of concurrent users accessing virtually unlimited-sized databases in low-bandwidths, giving each user uninterrupted viewing. This is achieved by allowing the client quick access to low-resolution scenes around the current location and then providing high-resolution information based on the user's speed and direction, while allowing for real-time changes in navigation.

3. CONCEPTUAL AND TECHNOLOGICAL IMPLICATIONS

In the context of the green spaces project, I will now deal with the implications of the individual’s perspective implementation on the planning process and on the technological components of WPSS.

3.1 The conceptual dimension

“Participation in the traditional planning process is primarily undertaken by large organizations or pressure groups with vested interests, as opposed to individuals and small community groups.” [5, p. 907]. WPSS provides an opportunity to change this situation, but the ultimate success or failure depends, among other factors, on the degree of involvement of the public in using the system (2, p. 903). The individual’s perspective can contribute to the effectiveness of WPSS by increasing the degree of public usage of the system and by improving information on local spatial scale in which people are interested. Furthermore, as opposed to ambiguous aggregate data, information on the individual level (e.g. walking distance range) is simpler and more understandable, with less possibility for interpretation and manipulation; thus, individuals and small community groups can easily protect their interests.
Regarding the community interests, the individual’s perspective can play in two
directions. On the one hand, information that supports self-interest can exacerbate the
NIMBY (Not In My Back Yard) phenomena. Namely, actions of individuals can interrupt the
community’s interests in the planning process. On the other hand, the individual and
community motivations are not necessarily considered as alternatives or different entities,
but as complement forms of participation. Therefore, providing information that is also
relevant to the individual’s interests can be seen to encourage better communication of
information between the individual and community levels, and by that contribute to the
institution of planning processes with the full sense of the “bottom-up” participation notion
[12]. Second, the individual’s perspective, by definition, ensures the securing of individual
rights: Each individual can protect his or her right to public resources such as green spaces
within an acceptable walking distance. This contributes to creating equality among citizens,
as an expression of the notion of citizenship that lies at the heart of much communitarian
thinking. Third, information on the individual level provides a common language for individual
and community interests - that is the rights and interests of the individual and the community
are expressed in the same terms. For example, the individual needs a sufficient amount of
green space (at least 7 sqm) and the community needs the same averaged amount for its
members.

3.2 The technological dimension
Several studies have examined the technological dimension of WPSS tools provided
for participation, in the context of aspects that need to be achieved - interactivity,
communication between users, analysis, visualization, understanding and access [10,11,13].
The main conclusion of these studies is that we don’t have comprehensive tools to achieve
all the aspects, either locally or across a network. In other words, current technology offers
no universal solution for full integration Internet-GIS-VR. We will have to make trade-offs in
the desired ultimate aspects of public participation in order to create appropriate WPSS
according to the issue at hand, the resources available, and the demands and aspirations of
the intended end users [10].

The implementation of the individual’s perspective requires high-resolution
geographical data and detailed visualized information that increases the tension that already
exists between the aspects (visualization, access, interactivity etc.) and tools (Internet-GIS-
VR) of WPSS. However for the specific case of the WPSS design for awareness and
participation in green spaces planning, the aim was to enable realistic representation of the
urban environment, real-time movement and the presentation of relevant geographic
information in a virtual environment. These requirements entail concessions on important
aspects such as interactivity between users and GIS analytical capabilities. Another
requirement of such implementation is the availability of georeferenced demographic data at
a resolution of buildings.

Finally, further research is needed to assess the effectiveness of individual’s
perspective-based WPSS on the planning process, and in order for implementation to occur,
ways towards more integration of Internet-GIS-VR need to be developed.

4. REFERENCES

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