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Evaluating Sustainable Appropriation of Urban Public Parks

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1 INTRODUCTION

Urban public parks offer a great potential to raise the quality of life for urban citizens, while at the same time their creation and maintenance requires substantious amounts of money. Surveys have shown that citizens consider parks to be an important element for their well-being, even if used only occasionally. By offering opportunities for equal participation irrespective of gender, age, nationality or social-economic status, parks also enhance social sustainability. We consider social sustainability as the necessary element for the two remaining pillars of sustainability, namely economic and ecological. By equal participation, we mean the possibility for every potential and actual park user to engage in activities as desired, as long as these activities do not prohibit or discourage others to use the park. There are two processes opposing equal participation: First, if a park user leaves or does not show up at all because he or she does not feel comfortable in the park, we speak of processes of exclusion. If the space appropriation in the park is dominated by a certain group of visitors, then there are processes of domination.

We assume that the specific behavior settings of parks (in the sense of SCHOGGEN 1989[7])) and management strategies (KAPLAN et al. 1998) strongly affect visitors' behavior by affording certain activities while discouraging others. Thus, both the design and the management can contribute to minimize usage conflicts and ensure social sustainability. Consequently, the design and management of public parks and recreation areas have attracted a substantial amount of interest. Academical research ranges from technical aspects of counting visitors (ARNBERGER et al. 2006), the usage of parks (BRANDENBURG et al. 2006), a focus on gender issues (PARAVICINI 2002) to more conceptual and theoretical publications on the social construction of public space and its appropriation (KASPAR and BÜHLER 2006, LÖW 2001). On a more administrative level, the postulates of social sustainability and intensive usage of public parks are integrated into the agenda of the city of Zurich, for example (GRÜNSTADTZÜRICH 2006). The spatial distribution of park usage has already been observed in Basel (BAUR 2000), although the resolution is coarse.

In order to enable and foster equal participation, it is necessary to detect and analyze domination and exclusion processes. To do so, our research project uses a mixed methods approach (CRESWELL 2003). We combine qualitative methods such as in-depth interviews and document analysis with observations of park usage, and their subsequent quantitative analysis with geographical information systems and supporting information technology. The latter, quantitative methods will be presented in this paper.


Figure 1: Extensive (Wahlenpark, left) and intensive (Bäckeranlage, right) use of public parks (photographs taken by the author, Zurich 2006)

Our aim is to model the social interaction and resulting space usage in urban public parks at the micro level of individuals.We propose that it is possible to capture and represent the complex interpersonal processes of space use and appropriation on the microlevel using a relatively simple model. This model implements

[7] The notion of behaviours settings goes back to Roger G. Barker (1968). In essence, it assumes that there is a structuration of the environment into discernable settings that influence strongly one's behaviour.

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concepts from anthropology and environmental psychology. The main components are socially constructed spaces of interpersonal distances. We show that the use of space and resulting conflicts between park visitors can be modelled using information about the environment (i.e. affordances[8] of the park infrastructure), the activities of the park users and a few individual characteristics such as age and gender. A comparison between several visualization and modelling approaches reveals that dynamic field-based visualizations show the most promise. With our model, it will be possible to evaluate the acceptance and use of urban public parks by the planning authorities with methods that go beyond the traditional surveys. In a next step, we plan to implement a simulation of space appropriation, so that the use of the park's infrastructure can be simulated even before it is actually built.

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2 CONCEPTS OF SPACE APPROPRIATION

In order to detect and analyze processes of exclusion and domination, it is necessary to reveal conflicts in space appropriation. We conceptualize conflicts of space appropriation mainly as an effect of crowding in the sense of ALTMAN (1975), namely when the level of achieved privacy is less than the level of desired privacy. Altman describes four principal methods for regulating the achieved privacy. He calls these principal methods interpersonal control mechanisms. They are: a) verbal behaviour, b) non-verbal behaviour, c) territory, and d) personal spaces. In our case, we will focus on personal spaces as main control mechanism, disregarding the other three. Judging from our observations, personal spaces are the most relevant one. Instead of engaging in (non-) verbal exchange or claiming a delimited territory, rebuilding a certain distance to a nuisance or intrusion is much more common.

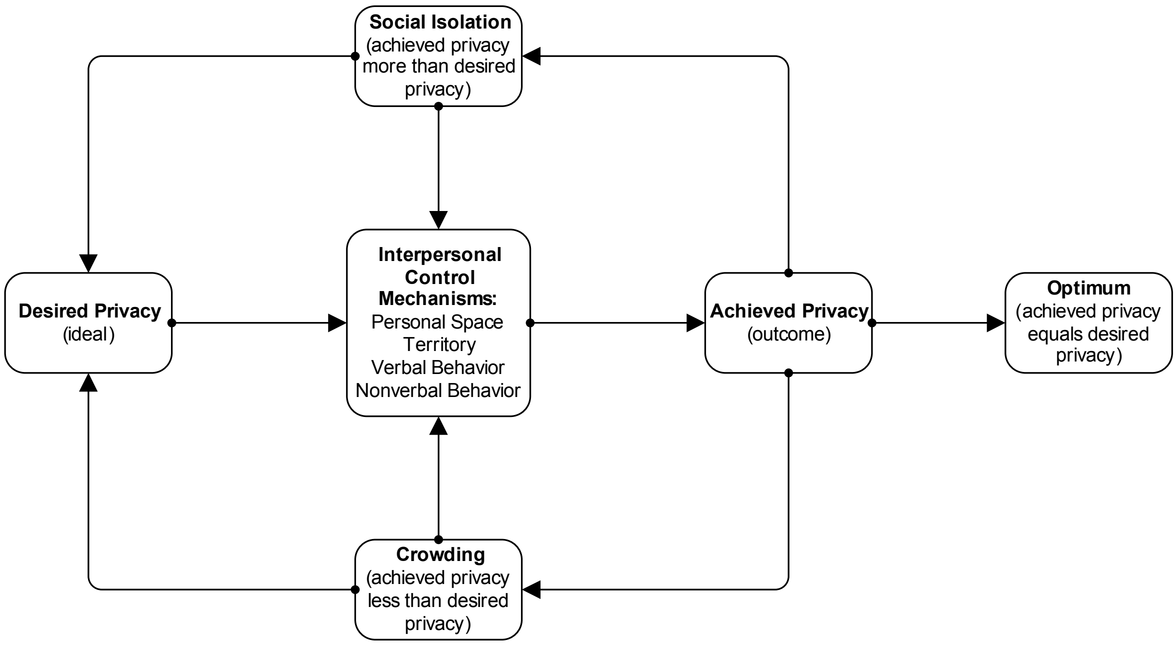

Figure 2: Overview of relationships among privacy, personal space, territory and crowding (ALTMAN 1975: 7)

Personal spaces according to HALL (1966) can be conceptualized as a succession of four concentric spheres with a person at the core: Intimate distance covers the range up to 45 cm (18 inches), personal distance spans the range from 45 cm up to 120 cm (4 feet), followed by social distance that ranges up to 3,6 m (12 feet) and public distance (7,5 m or 25 feet). For the deliminations of these spaces, the distance itself is less significant. The interpersonal distance zones are mainly a result of the communication cues possible, e.g. whether facial

[8]The concept of affordances was created by James J. Gibson (1979). It assumes that objects afford certain positive or negative possibilities of action (such as a chair affords sitting on it) that are intuitively grasped by animals and people without cognitive processes involved.

expressions are discernable, whether touch is unavoidable or (im-)possible, etc.. Unwanted, inappropriate intrusion into these spaces by others can lead to anxiety or discomfort, depending on the relationship between the individuals. As argued by BAXTER (1970) and ALTMAN (1975), these interpersonal distance zones also vary with age, gender and ethnicity. For the beginning we will focus on their relevance for activities, since we have to simplify our model at the start. Incorporating others aspects, such as modifying shape and size of personal spaces according to activity or individual characteristics will be possible later on.

During our extended observations in public parks of Zurich, the following groups of activities have been observed:

- Non-interactive (sleeping, reading, and working)
- Interactive (chatting, observing, overseeing children)
- Eating (picnicking and BBQ)
- Ball games (football, badminton)
- Activities relying on the park's infrastrucuture (such as playgrounds, water basins)
- Other activities on the spot
- Other activities involving movement.

Each of these activities requires a specific space that we call the activity's footprint. The footprint's size and shape is estimated from literature and observations.

We assume the potential for conflict exists when personal spaces and (incompatible) activity footprints of other park visitors overlap. In an example (see Figure 3 below), we look at a football player (left) and a reader (right) and their respective activity footprints (AF) and personal spaces where intrusion is experienced as a disturbance (PS). We assume that the football player's activity footprint is large and disturbs the reader already at the distance of the reader's social distance zone, thus an overlapping provokes a conflict from the reader's perspective. On the other hand, the small activity footprint of the reader will rarely overlap the relatively small personal space in which the football player feels disturbed. This is due to his physical activity, so that he is only disturbed by intrusions beyond the personal distance zone (and probably only if that intrusion constitutes a foul by a fellow player).

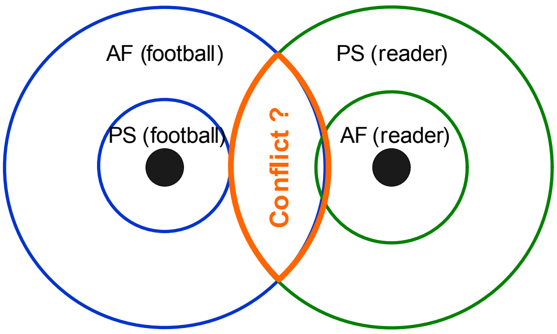

Figure 3: Potential conflicts from overlapping space appropriation

3 DATA CAPTURE AND STORAGE

The empirical data was gathered during field observations in Zurich, Switzerland. During the summer of 2005, one park (the Wahlenpark) was observed on 12 days for several hours each, In the summer of 2006, another two public parks (the Wahlepark again, and the Bäckeranlage) were systematically observed on 14 days for two hours each. The observation slots started on 12:00, 14:00, 16:00 or 18:00. The two parks are both rather small (not exceeding 2 ha) and designed for the local population without special infrastructure attracting visitors from farther away. The new Wahlenpark is located in a large industrial-to-residential conversion zone, while the Bäckeranlage dates back several decades and is located in an innercity residential quarter. In 2007, the Bäckeranlage plus a third park will be observed using the same scheduling. The first observations in 2005 used pen and paper to write down location, time, activity, gender, and age of the visitors. These records were later digitized in ArcGIS, using a standard file-based approach. For 2006, the methods were refind. Using TabletPCs, the observations were directly coded into an ArcGIS personal geodatabase, with a total of 605 and 842 parks visitors recorded. The individual attributes recorded include estimated age (infant, child, teenager, young adult, senior adult, senior), gender (male, female, unknown) and association to a group of visitors. This information is stored in a table and linked via ID to an event table that contains the locations of the individuals, time of events and types of activity (compare figure 4, which is in simplified STER notation adopted from TRYFONA et al. 2003). Both changes in location or activity constitute an event. Our conceptualization of time therefore is linear and discrete.

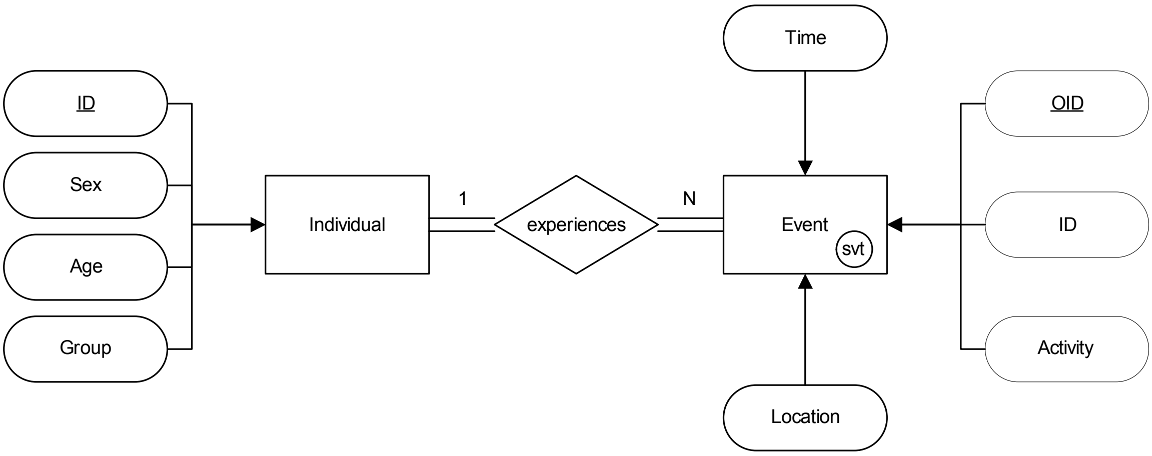

Figure 4: Data model

4 ANALYSIS AND DETECTION OF CONFLICTS

Visual analysis and descriptive statistics for the two parks already indicated interesting trends regarding the spatio-temporal distribution of gender, age and activities, as well as clusters in attribute space (activity/gender, for example). These trends will have to be tested statistically and will be published later. In this section, we will describe our analytical approach for the detection of (potential) conflicts in the usage of the parks.

First efforts for visualizing and calculating space appropriation used the discrete and object-based approach of the data for calculating (potential) conflicts. It coupled GIS analysis and visualization with calculations in a Java program. This approach proved to be both cumbersome and not very efficient. Even more important, personal spaces and activity footprints do not have crisp boundaries, as this approach suggests. Instead, they have vague boundaries, which is due to positional inaccuracy during data capture, and the generalization introduced by the categorization of activities and visitors. The inherent uncertainty of the boundaries can also be addressed by using fuzzy instead of crisp boundaries, with appropriate intrinsic or extrinsic visualization methods. In order to address the mentioned shortcomings of the object-based approach, we decided to use field-based representations.

One possibility to generate activity footprints and personal spaces is to calculate a density surface for each single visitor or group of visitors carrying out an activity together. Using different parameters for the calculations according to activity, density layers are generated that can be checked for overlaps, i.e. conflicts. At the same time, they can give an estimation of the relative intensity of the (potential) conflict (for density surfaces of activities, compare KWAN 2000). So far, we have used this approach with success to visualize distribution of gender and age, while first trial runs on activities were conducted (see below).

Figure 5 shows the Wahlenpark and the distribution of visitors according to gender. Clearly, it is difficult to discern patterns visually from the overlapping points. For one of the days, we calculated the relative density of male and female park visitors. Figure 6 shows this relative density by displaying a higher density of female visitors with peaks (green), while the troughs (red) represent a higher density of male visitors. The visualization suggests a clustering around certain elements of the park infrastructure. While female visitors seem to gather around benches and playgrounds and the fringes of the park, male visitors occupy more of the open spaces in the center.

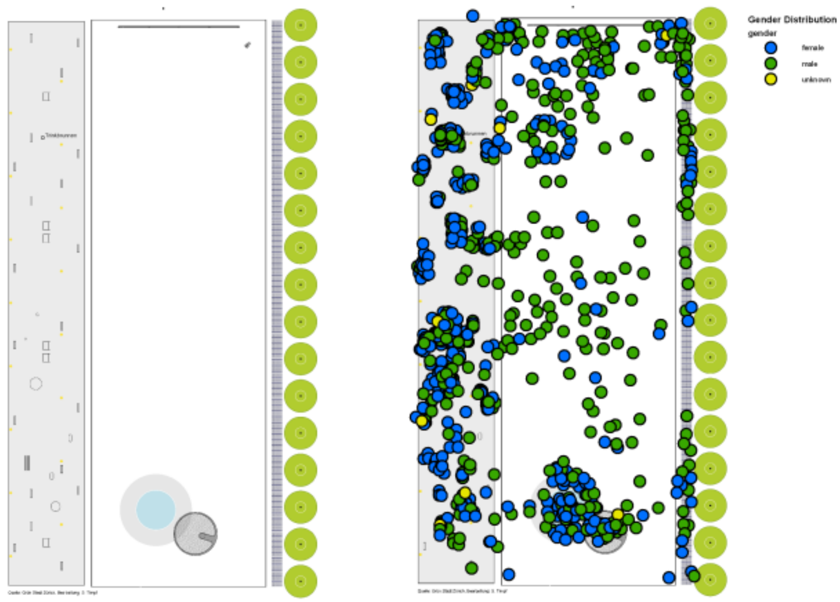

Figure 5: On the left hand side, the Wahlenpark viewed from above (water basin and canopy for providing shade towards the lower end, benches and playground on the grey strip to the left, large open grass area shown as white area in the middle, trees on the right); on the right hand side, the distribution of all visitors according to gender.

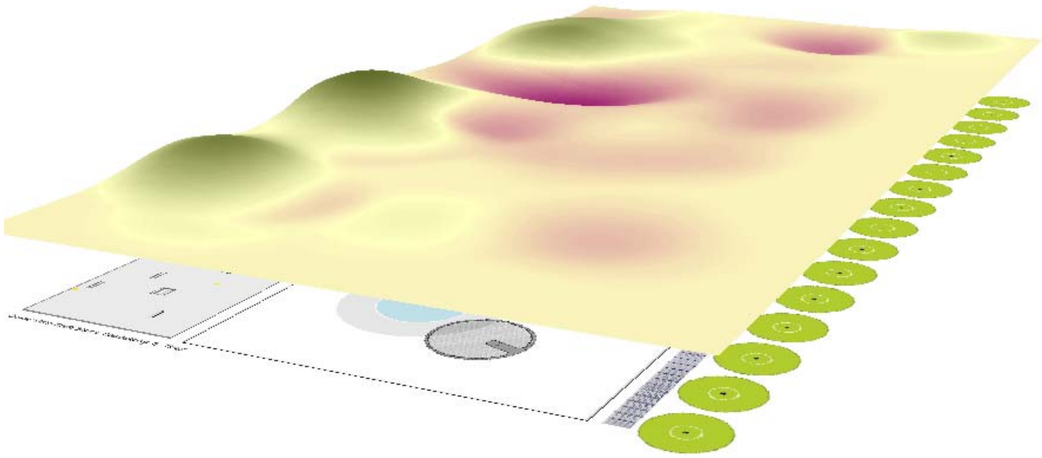

Figure 6: Relative density of female and male park visitors

In order to test a similar approach for different kinds of activities, we reduced the amount of data. With a smaller subset derived from one of datasets, the following calculations were made. First of all, coming back to our original model of space appropriation, we presume that there are no conflicts of space appropriation within one group of visitors. Group in our case means that its members obviously know each other and participate together in various activities. So, the first step was to group the individuals according to group membership as recorded during the observations. If several activities by individual group members were carried out, the prevalent one was chosen as group activity. In a next step, for each group two kernel densities were calculated: One for the activity footprint, and one for the personal space. As already mentioned in our example in Figure 3, different activities have different activity footprints and personal spaces. To account for this, we chose different radii and population values for the kernel density calculations. It is important to remember that these values at this stage of research are assumptions grounded in own experience and observations. They have to be verified and refined. Additionally, for the sake of simplicity, we operated with circular activity footprints and personal spaces. Each group's activity footprint was then checked against the personal spaces of all other groups via map multiplications, so that only overlapping spaces would retain any value at all. The resulting fields of potential or actual conflicts of space appropriation were then added together to provide an overview (see Figure 8). A simplified workflow is displayed in Figure 7.

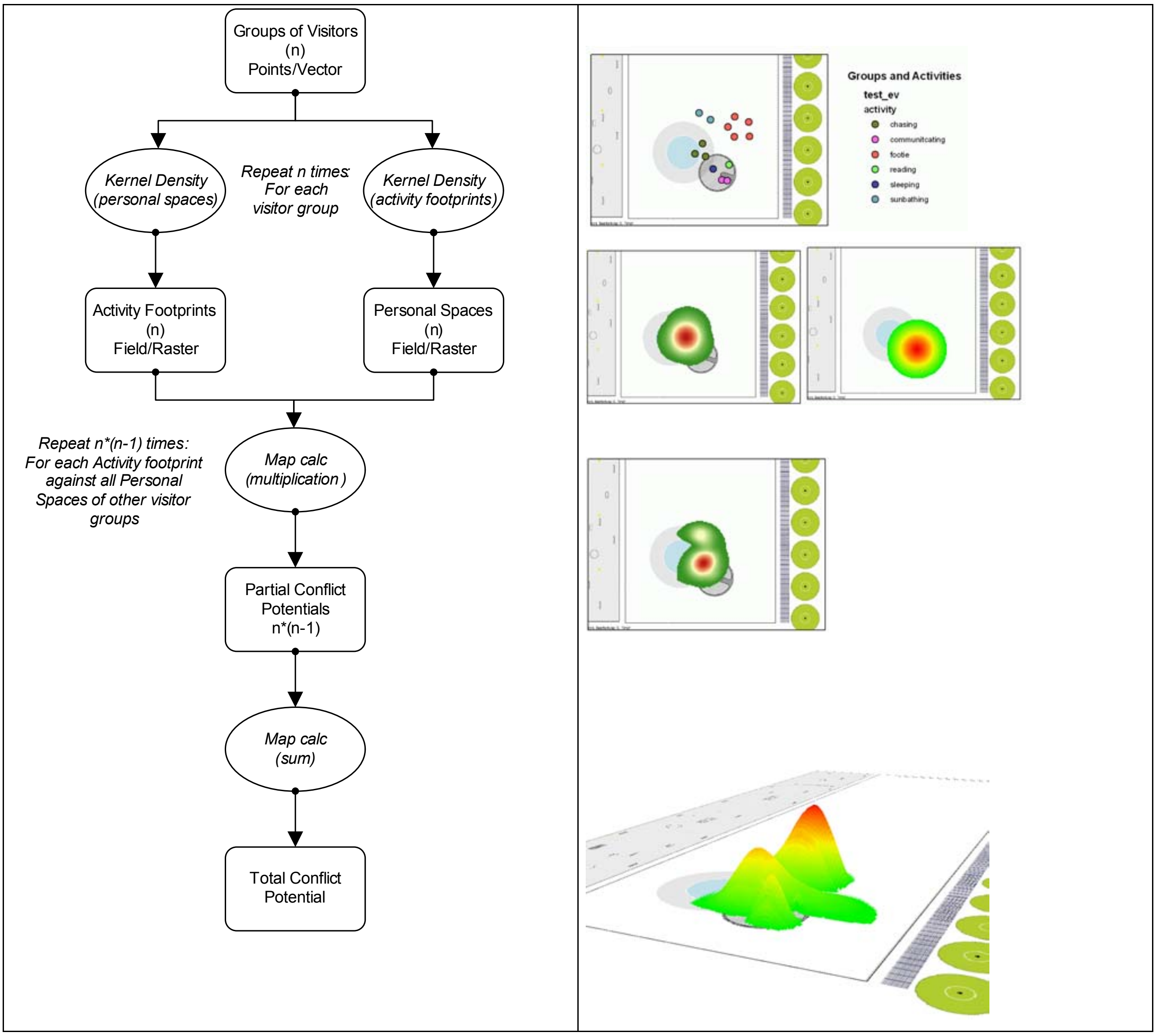

Figure 7: Workflow

5 CONCLUSIONS AND OUTLOOK

The first testing of methods and the results show that our goal of modelling social interaction at the micro level is already possible with the use of only the most relevant input information, namely environment and type of activity. Other topics such as gender conflicts, park appeal for varying age groups, nationality or ethnicity could in principle be also modelled with this method. We use both original and already applied methods on newly captured data, integrating them with developments from diverse fields such as environmental psychology, anthropology and geographical information science and visualization.

In order to discover the processes and interactions adequately, it is also necessary to take the temporal dimension into account (PEUQUET 1994). The animation of the object-based event data is already possible via the use of the TrackingAnalyst in ArcGIS, while an animation of the 3D density surfaces will require additional effort.

Our aim is to provide an intuitively understandable representation for exploratory analysis first, before allowing the user to drill down and analyse the data with geostatistical methods such as clustering, dispersion or motion pattern analysis. Thereby the interface can be tailored towards the specific needs of user communities such as administration, planning and research. Recent test runs of geovisualization tools and methods in the community of forest officials and rangers have shown, that the requirements of the specific user groups vary greatly (ANDRIENKO et al. 2006). Representing the academic community, we already work in collaboration with practitioners such as the planning department of Zurich. We intend to test our methods and tools with different user groups.

Multi-agent systems offer the possibility to simulate space appropriation with different samples of park users and to try out the effects of various elements of park design. Another method for modelling conflicts of users in our study is the implementation of user behaviour in a multi-agent system (WEISS 1999). A multi-agent system allows for reproducing the behaviour of the environment and of individuals at a micro level at the same time as at a group level. In our MA simulation potential conflicts show up in the behaviour of the agents - agents try to avoid conflicts and will leave the park if they cannot pursue their activity without conflicts. A potential conflict is highlighted using the colour of the agent icon (from green to red). Other solutions such as change of activity instead of location, or verbal communication would also be possible.Depending on the intention of the user, the integration could be either GIS- or MAS-centric, with both elements closely coupled (compare BROWN et al., 2005).

Our research offers to contribute to the facilitation of park design and management. It should be possible to analyse parks already built that do not “function” as planned, and also to aid in the design of new parks.

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