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Assessing Trail Use Conditions Using Still Renderings and 3D Computer Animation

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Introduction

Research on crowding and social carrying capacities has become a very important scientific field in the past few years. Many urban recreation areas suffer from a high density of visitors, user conflicts such as between bikers and walkers and diverse visitor behaviours. In order to assess visitor preferences and tolerances as a basis for urban trail management, several studies have been carried out using photos or computer manipulated images. The advantage of image-based approaches is that the effects associated with crowding, especially in high-use situations, are more conducive to present than verbal descriptions. However, static images or photos may have some limitations caused by the lack of information and perceptions visitors would have in the real world, such as motion, sound and smell. This study compares a static research method using still renderings with a dynamic method by means of 3D computer animations.

Methods

In this study 150 students evaluated 32 still rendering sets, each consisting of two still renderings and 32 3D animation sets also consisting of two animations. In both methods, static and dynamic, the same three parameters each with three levels were shown. The attributes used for still renderings and animations were the number of visitors, the visitor type and the direction of movement (Table 1). Attached to the visual part of the questionnaire, there were questions about recreation behaviour, recreation specialisation, TV/computer experience and how the test persons felt about the renderings/animations.

The still renderings and 3D computer animations were created in 3d Studio Max. For the environment a retouched digital photo from a real urban park in Vienna was used and put into the scene as a background mapping. The pedestrians and cyclists were modelled with 3D polygon meshes, and mapped with unwrapped UVW mapping coordinates. For the dynamic animations all the persons were rigged. The character animation was defined via footstep animation with adjustments for the walkers, and via free form animation, hierarchical motion connections and path follow constrains for the cyclists. A full factorial design was used. Thus 27 still renderings and 27 computer animations were produced and compiled into 32 choice sets. For the still renderings a typical mo-

Table 1: Attributes and their levels; each still rendering and each 3D animation depicts a different combination of theses attributes.

Attribute		**Attribute levels**		
Number of visitors		**4**	**8**	**16**
Visitor types	biker/walker	**25%/75%**	**50%/50%**	**75%/25%**
Direction of movements	towards/away	**25%/75%**	**50%/50%**	**75%/25%**

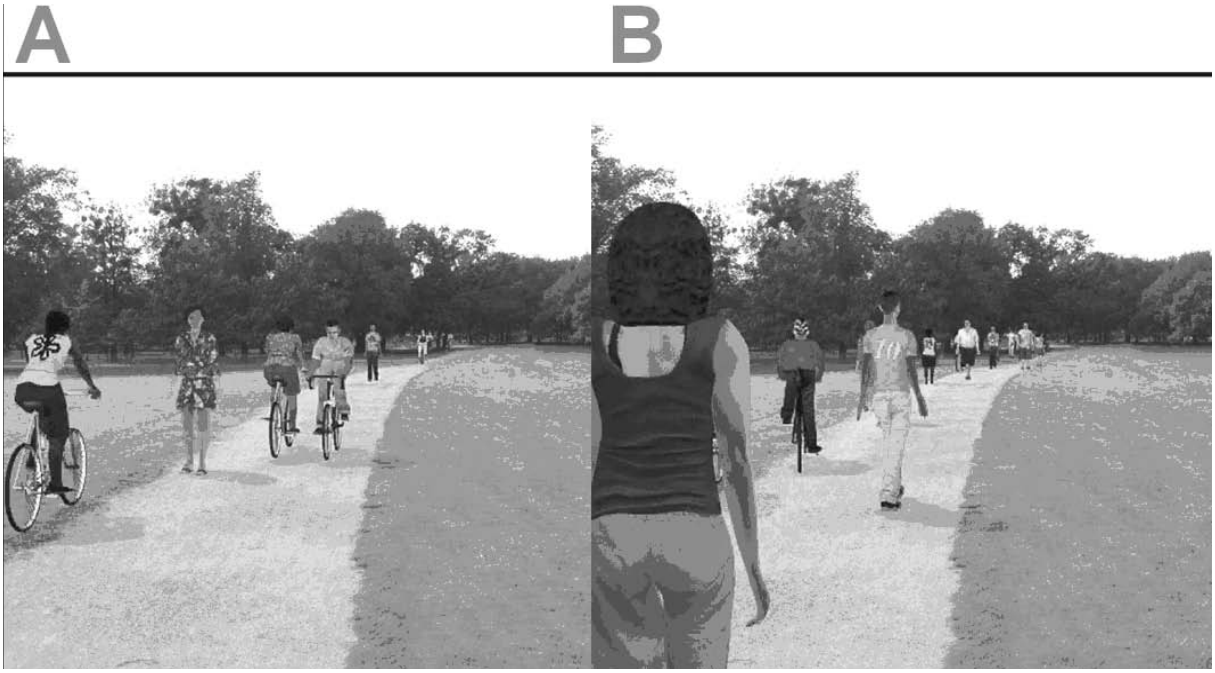

Figure 1: Choice set consisting of two still renderings.

ment of the 20 sec animation strip was extracted and saved as a static slide. The animated filmstrips had 400 frames each and were looped three times when shown to the test persons. Therefore, for each set the respondent had 60 seconds to answer five questions related to the films and still renderings. The students had to choose which scenario of the two they prefer, where they would not walk, ride a bike, or jog anymore, and which scenarios they think are still tolerable. All choice sets where shown in a standardized manner with two video beamers to two different groups at the same time. Each student evaluated eight 3D animation sets and eight still rendering sets.

Results

The study showed that the evaluation of static versus dynamic scenarios led to different results. In general trail scenarios based on the 3D animations tended to be less preferred by students compared to still renderings.

Regarding recreational activities, in 35% of the scenarios based on still renderings the students would not walk anymore, while this number increased to 38% based on the animations. For jogging and cycling activities only slightly different results were gained. The study also showed that at mid use levels the results for the static and dynamic scenarios were rather similar, but at high use densities (16 persons in view) the evaluation differed dramatically. Compared to low use levels, at high use situations animations were over proportionally regarded as more preventing from recreational activities than still renderings.

Across all scenarios, 52% of the still renderings were judged as tolerable. This share decreased to 49% when the same scenarios but in motion were evaluated. In the next step data will be analyzed using multivariate methods (multinomial logistic analysis).

The respondents were also asked about the suitability of the still renderings and animations for the evaluation of trail use scenarios. While for still renderings 54% of the students answered they could place themselves “well” or “very well” into the shown scenarios, for the animations even 60 % answered with “well” or “very well”.

Study limitations

Even if dynamic 3D computer animations are closer to the real world scenery than still renderings, they are always abstractions of the real situation visitors would find in urban parks. There are still many parameters that could influence the evaluation of the scenarios very strongly (sound, smell, and place).