COMPARISON OF MOVEMENT MODELS BETWEEN REAL AND VIRTUAL ENVIRONMENTS

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Abstract

The goal of this paper is to analyse the movement models in 3D multi-user virtual environments in terms of the interaction between users and the degree their analogy to real world movement models. The procedure followed is the examination of movement models occurring in real space and virtual simulation of Topkapı Museum Treasury Section with space syntax analysis and the comparison of the two distinct data sets gathered. Topkapi Museum, which is a world-wide known cultural heritage of Turkey has especially been selected as the case since spatial perception defined by movement models is an important feature for museum typologies. Initially, the movement models in real space are determined both by observational methods; tracing the visitors during their visits, and analytic methods; using syntactic softwares AJAX and DEPTHMAP. On the other hand, a 3D virtual simulation of Topkapı is constituted and loaded to Active Worlds, a multi-user virtual environment. The subjects inside the model are observed and queried about their virtual experiences. Finally, the two data sets gathered from both environments are compared to reveal the degree of analogy between movement models in multi-user real and virtual space. Concerning these findings, the advantages that are provided to users by the transition of real space to virtual space are accentuated. For future suggestions, it is indicated that within the evolution of virtual reality, the human factor should be taken into consideration along with architectural features. Besides it is emphasized three-dimensional multi-user virtual environments could be efficient mediums for hosting cultural heritages since the virtual experience is further enriched by the interaction between users.

Introduction

With the advancement of information technologies, virtual environments are becoming more complicated each day by means of their contents and structures. Today being capable of presenting data three dimensionally, virtual environments alternate the way users reach data and percept the space where data is stored. So far, several space syntax researchers have questioned the extend to which virtual environments can resemble the real world on spatial means. The data gathered from the virtual environments have been compared with the real world data and it has been proved that the

virtual and the real are analog to such an extent that the two mediums can refer to each other (Conroy, 2001). However, the condition of being single-user or multi-user which alternate the interaction models, hence the movement models have been disregarded. The paper aims to analyse the movement models observed in 3D multi-user virtual environments by noticing the interaction between users and the extend to which these models resemble the models in real world (Girginkaya, 2006).

Analyses of User's Movement in Real Space

Observational Methods in 'Real Treasury'

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In this phase, subjects within 'real Treasury' were traced throughout their visits in and questionnaired afterwards. They were totally 10 people of whom 4 were peculiarly invited to the museum. The rest 6 were random visitors consisting of 2 native and 4 foreign tourists. The average age is 32 and the ratio of women to men is 3/2. 3 of subjects were designers. Besides a paralysed person and a kindergarten pupil were also traced for the potential of varying movement models they could display. Throughout the observation, none of the visitors did perceive the presence of the observer.

Figure 1:

Plan of Topkapı Museum Treasury Section
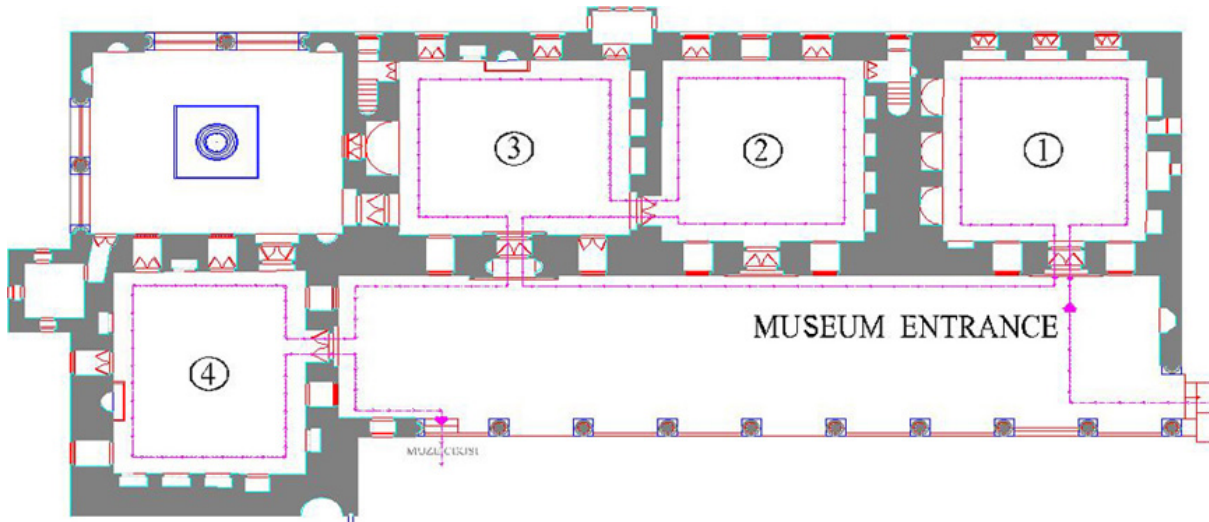
The results of the observations and queries in real Topkapı conveyed the statements below.

- The Treasury section was one of the most popular parts of Topkapı for the significance of the displays. The number of visitors changed according to the wheathercast and was more on weekends. The average was minimum 1000 and maximum 5000 daily.

- Visitors were expected follow the predefined route which was indicated by several signboards placed in front of the entrances of the rooms. People who approached from the right portico mostly could not discern the board in front of the 1st room and instinctly directed themselves to the 4th room.

- In each of the rooms the general movement flow was from right to left. However some visitors preferred to determine their own routes according to their individual interests and the feeling of disturb caused by the crowdness.

- Most of the visitors were foreigners who arrived in groups. There were many native student groups who came for educational goals. These young pupils who were not so much used to general museum visiting rules created crowd and noise which disturbed the rest.

- The subjects who arrived in groups seperated in a few minutes times. They occasionally recoupled to debate.

- Due to the flatness of the ground, paralysed subject could move individually. He neither spent more time nor followed a different route than the other subjects.

- The exhibition concept which was the display of 3D objects in niches inside the walls as if they were 2D paintings limited the movement fields around the objects and the personal spaces of the subjects.

- The bigger and more precious objects attracted much interest within the whole range of displays.

- Subjects with audio-guide became more acknowledged about the space and the objects.

- Though much attention was paid to read the signboards, subjects could recall neither the contents, periods or properties of the displays.

- Due to its function as an exhibition area, the architectural pecularities of the historical space was not perceived by the visitors.

- The subjects found the interior illumination levels poor. However this could especially had been proposed by the designer of the restoration project in order to draw visitors' attention to objects rather than the space itself.

- The queries revealed that none of the visitors had visited a web site to get information before their visits. All they used were books, booklets or brochures.

- The visitors recited that it would be really informative if a book including the images of all the pieces of the exhibition.

- Since the exhibitions were static, visitors remarked that they would not optionally visit the place a second time (Girginkaya, 2006).

Analytic Methods in 'Real Treasury'
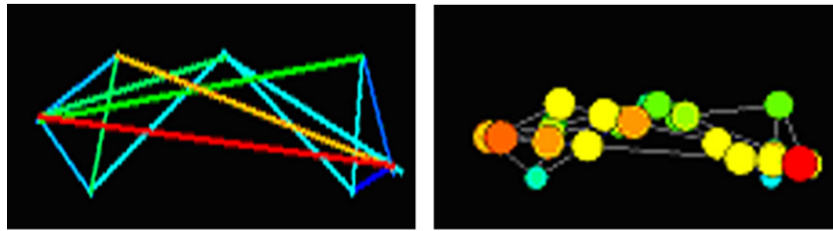
AJAX application in 'real treasury'

In this phase, an analytic method was applied on 'real Treasury' with AJAX which was developed by Batty in CASA in 2005. In the analysis, the locations where the route choice desicions had to be taken were considered. These were totally seven which were rightside, right front and left front portico entrances and the doorways of each four rooms. The movement models were assigned according to the visibility relationships between these locations. Hence the directions, such as between the right front portico and the entrance of the 1st room, right front portico and the 4th room, between the adjacent rooms, where the collonades blocked the visibility were disregarded. Since the directions had to be drawn manually in AJAX interface, the location and intersection of the axial lines changed in each application. However this fact had a limited and local effect and did not effect the general scheme of movement models.

The integration and the depth maps constituted by AJAX revealed that the axial line between 4th room and right front portico was the most integrated while the 1st room had the least visibility. Indeed this situation contradicted with the officially proposed visitor route. The visitors who approached treasury from the right side portico mainly were expected to enter the 1st room which was entirely out of the visibility field. The people who headed themselves instinctively to the 4th room were warned by the signboards and security guards that
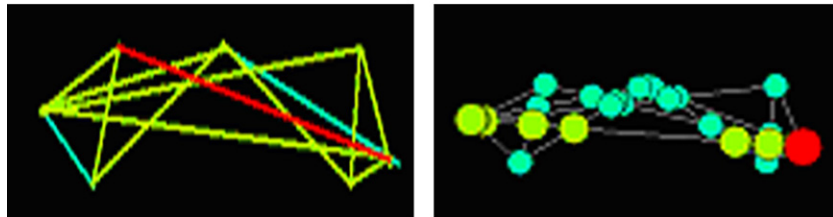
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they should begin from the 1st room. So they had to turn back to begin their visits.

Figure 2:

The integration maps and depth maps in AJAX

The integration maps of axial lines and intersections


The depth maps of axial lines and intersections

**DEPTHMAP application in 'real treasury'**

In this phase, an analytic method was applied on 'real Treasury' with DEPTHMAP which was developed by Turner in University College London. The analysis focused on the movement and pedestrian flow rather than the visibility. The furnitures like benches and couches which would effect the movement models were disregarded since they were not built-in elements of the space.

Figure 3:

The connectivity map and visual mean depth map in DEPTHMAP
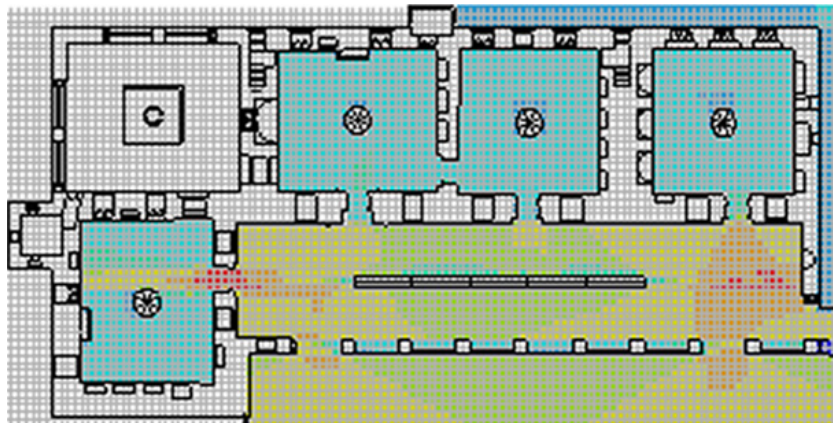
The Connectivity Map in DEPTHMAP
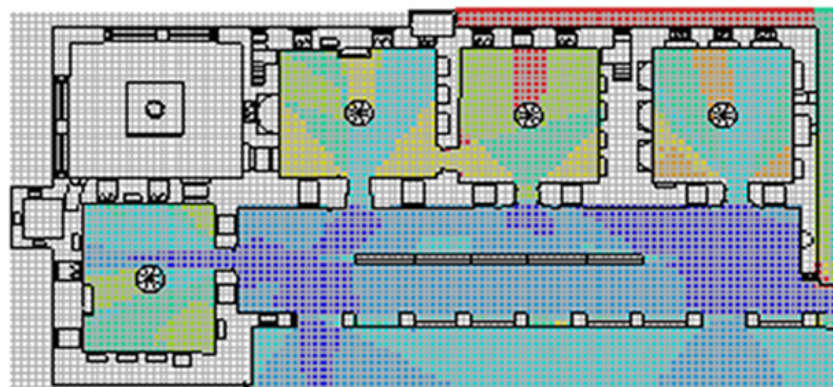
The Visual Mean Depth Map in DEPTHMAP

The connectivity and visual mean depth maps produced by DEPTHMAP revealed that the 4th room and the 1st room doorways had the maximum connectivity and minimum visual mean depth values. Hence the selection of one of these rooms as the initial and

dominant space of the visit seemed convenient. Therefore the current use of the first room being charged as the starting point of the trip at first seemed right. But the real world observations had proved that the 4th room would be the best choice.

Another point to be considered was the location of the most popular object, Kaşıkcı Elması in the most connected area. The choice of this location within all the possibilities conveyed the consciousness of the designer. The designer of the restoration project, certainly unfamiliar with the terminology of space syntax, had instinctively achieved an efficient design by only referring to his professional experience.

Building a 3D Virtual Model of a Real Space in order to Analyse User's Movement in Virtual Space

In this phase, a 3D virtual model of a real space was built and tested in a multi-user virtual environment in order to analyse the users' movement models (Girginkaya, 2006). Basing on the 2D plans and sections on AutoCAD format, a 3D model of Treasury was created on XP operating system with 3D Max and then loaded to Active Worlds. Active Worlds did only support the RWX file format, which was a script based render motor for VRML. So the *.max file was initially exported to VRML and finally saved in RWX format by a RWX exporter, AccuTrans 3D.

Figure 4:

Modeling virtual treasury
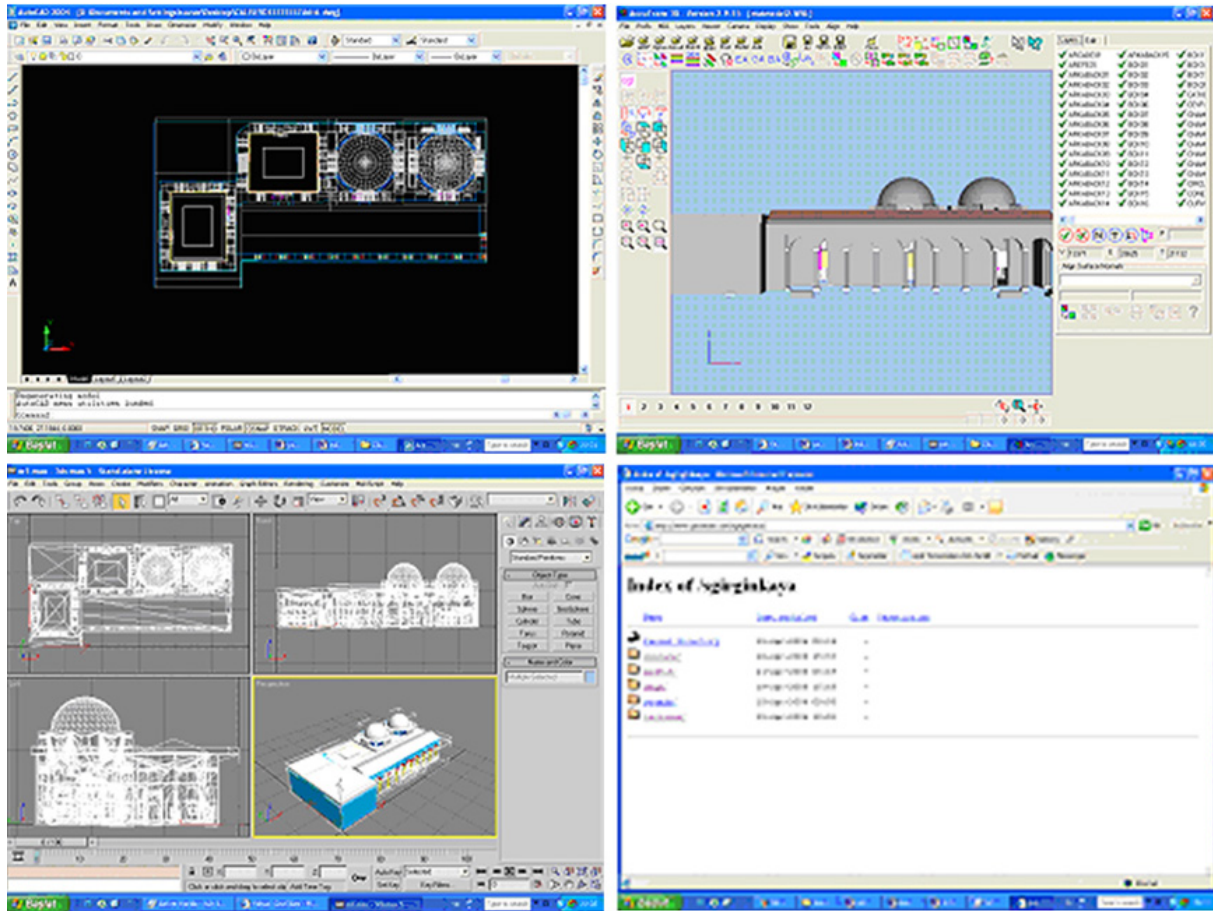
Active Worlds Browser 3.6 ve 3D Homepage Creator was downloaded from Internet. A citizenship was booked and a virtual world has been rented in the URL: http://www.activeworlds.com/3dhomepage/ goto.php?Treasury'. In order to constitute a personal object path for Treasury, a web site in the URL:www.geocities.com/sgirginkaya was formed. The parent directory was organized with five subfolders; models, avatars, seqs, sounds, textures. Then the zipped *.rwx file of the model, *.seq files of the movement models, avatars.dat file, and

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*.jpeg files were loaded to related folders. Particularly the avatars.dat file had to be prepared on Notepad for assigning some movement model to each of the avatars individually.

In total, 8 subjects, 3 of which were designers, were specified. The average age was 28 and the woman to men ratio was 3:5. The subjects were provided with computers having Internet and Active Worlds access. During the observations subjects were accompanied with the observer who actually did not interfere. Each of the subjects were required to explore Treasury for 10 minute periods under three different circumstances. In the first experiment, the subjects were alone in the Treasury. They had not been informed about how to move abound in Acvtiveworlds beforehand. The model consisted of only basic geometrical forms without any images or textures. The world had no gravitation and flying mode was permitted. In the second experiment, having been informed about the movement methods in Active Worlds, the subjects were expected to repeat their 10 minute-long visits in the textured version of the model. The gravitation was still off and flying mode was permitted. In the third experiment, Treasury was set as multi-user. Gravitation was on and flying was restricted. The model was simulated as much alike as its real.

Figure 5:

Screenshots from virtual treasury
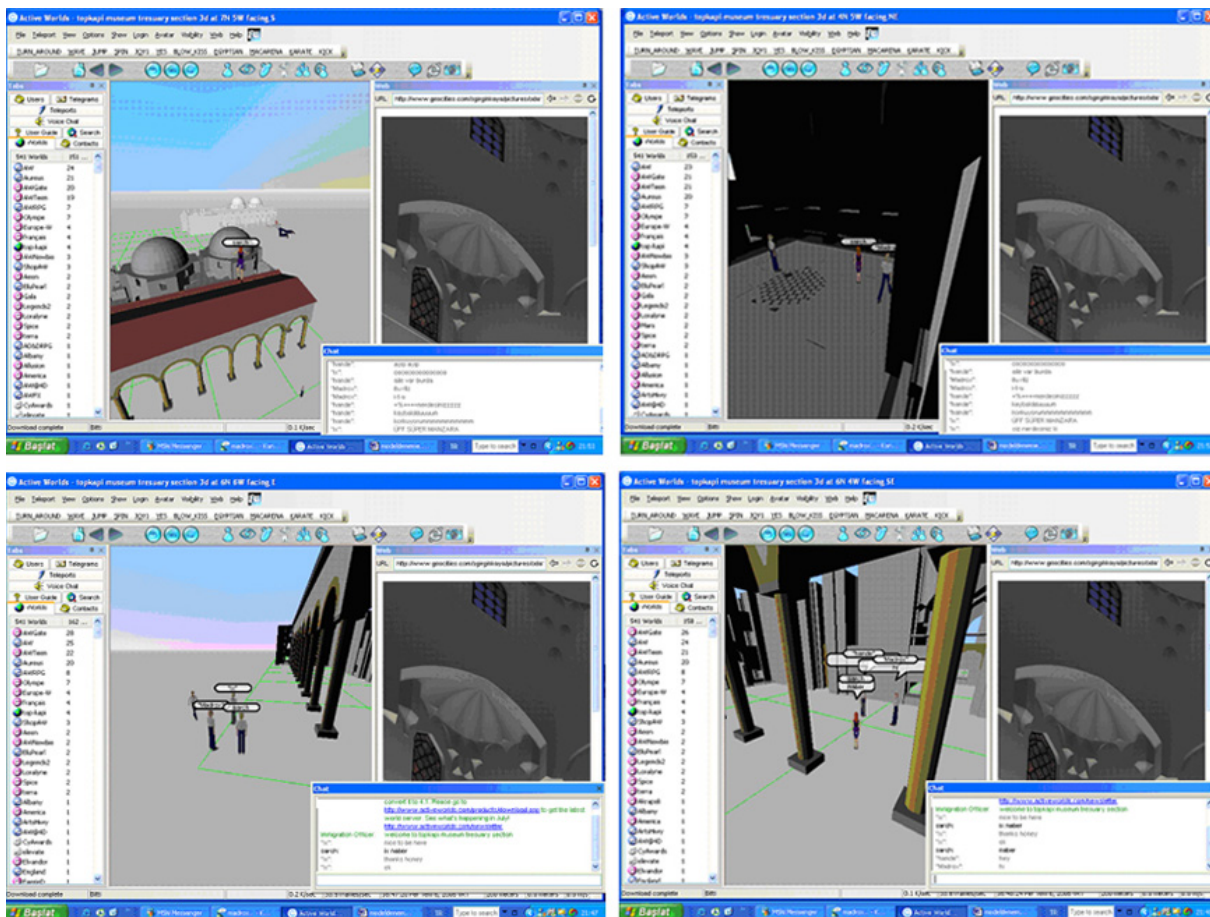
Discussion and Conclusions

It should firstly be emphasized that the goal of this paper is to propose the comparison of virtual and real space in terms of movement models of the subjects. The previous space syntax researches beforehand have always dismissed the personal movement tendecies of the users and analysed the space by means of its building components. Thus the model proposed here, compares the real world movement models, which are demanded by the spatial configuration and conveyed by

queries and observations, to virtual experience results. In this respect the analogy between the real and the virtual experience is determined.

The differences of the 'virtual Treasury' from the previously constituted 3D models are summarized below:

- The simulation of 'virtual Treasury' is multi-user. Due to this specification, users can interact with each other in virtual space as if they were in the real world. Consequently, besides the building elements, the presence of the users and the interaction between them play a role on the movement models.

- The configuration of the model is flexible in terms of its spatial means such as; its identity, scale, audio and visual components and its users such as; number, identity and personal background etc. With this configuration, many different spaces can be analyzed in terms of the movement models displayed by their users. The model can be an identical simulation of a real world building or an entirely fictional building varrying in quantitive and qualitative respects.

The analysis on the 'virtual Treasury' has revealed the tendency of the users to carry the real world movement models to the virtual environment. The hierarchy between the rooms of 'real Treasury' assigned by the spatial configuration was reflected to the movement models in 'virtual Treasury'. Although the analysis were restricted with observational methods (because the only analytic tool, VU-Flow (Ieronutti L & Ranon R & Chittaro L 2001) for analysing the data recorded in 3 dimensional virtual reality was stil in its initial progress) and no quantitive results could be acquired from the virtual environment, the queries proved that architectural facts and interaction could be perceived in virtuality as in real world. Though the types of experience and levels of perception change according to these two mediums, 'virtual Treasury' has clearly staged similar movement models to the 'real Treasury'.

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