Time Based Media as a Means to Enhance Spatial Representations

Teaching case studies in Greece

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This paper investigates the potential of time-based spatial representations as a means for enhancing our environmental perception – a tool for assessing and understanding space in the wider sense of the term. It attempts to document the way in which time-based representations of environments are addressed by architectural, planning and surveying education curricula in a number of related Departments in certain Greek Universities. More specifically, a report on the teaching practice and objectives of certain undergraduate and postgraduate courses, which deal with this issue in different ways, is made.

Keywords: *Time-based media; spatial representations; video; virtual reality; 3D modelling.*

Introduction

The aim of this paper is to investigate the manner in which time-based media (TBM) are integrated within the curricula of engineering departments in Greece as means for creating spatial representations. These representations may be utilised for enhancing our perception and understanding of environments, in the wider sense of the term.

At first, this paper attempts to justify the use of TBM as essential for creating dynamic representations of designed environments, which describe the spatial experience more appropriately than static representations created with traditional media. Taxonomy of TBM and of spatial representations, which may utilise them, is presented.

Finally a series of courses from engineering departments in Greece that integrate TBM into their teaching practice, is presented. These courses utilise TBM for the purpose of creating spatial representations of environments at varying scales. Such representations support the processes of analysing, evaluating or communicating a design. The courses presented in the following sections are:

- Geomatics course at the Department of Rural and Surveying Engineering, National Technical University of Athens (NTUA)
- courses at the Planning and Regional Development and the Department of Architecture University of Thessaly
- two architectural courses at the Department of Architecture, NTUA.

Constructing spatial representations with time-based media

We move continuously while perceiving the environment within which we exist. We may be in a state of locomotion while on a vehicle or while walking, or merely while moving our head around. Even when we are not moving within space, we never stop moving our eyes and through this movement we scan the environment that surrounds us and thus perceive this environment.

It is therefore understood that the parameter of time has a great influence on the manner that we perceive space. According to Michael, Guildford et al (1957), the capacity of a human for understanding his environment largely depends on associating his orientation with elements of his environment, while changing the position of his body in relation to these elements through time. In other words, while moving within our environment, we observe the relationship between our own body and several environmental elements and thus we understand the spatial arrangement of these elements and consequently formulate a mental model for this environment. Merlaeu-Ponty's (1962) phenomenological approach or J.J. Gibson's (1986) ecological approach towards the phenomenon of visual perception have also stressed the significance of movement of one's body within an environment as one of the main aspects of the process of visual and consequently environmental perception.

One cannot deny that static forms of representation can be very useful as means for describing and analysing an environment. However, we need dynamically evolving, iconic and descriptive representations of the experience of moving within an environment if we want to approach the spatial qualities and characteristics of this environment in an accurate and realistic manner. Dynamic spatial representations may also be utilised for describing certain environmental properties, which evolve through time. It can be suggested that if we want to represent a certain space by approaching the experience of being in this space, we should take the parameter of time into account. To achieve that, we need to make use of TBM.

TBM are:

- Film, the medium used for the production of cinema and animation.
- Video, which may come from an analogue or digital source, can be manipulated via analogue or digital processes and consequently be presented in a digital or analogue form. The process of recording video differs significantly from the process of recording film allowing for very easy or even real time reproduction of a scene. The immediacy of video as a means for capturing reality renders it as much more appropriate medium than film for recording spatial experiences.
- Finally the computer can be used for the digital processing of video, the creation of 3D graphics and animation as well as the production of real – time simulations of moving within certain computer generated environments (virtual reality).

  Although these types of spatial representation attempt to display three-dimensional environments, they can only be experienced via two-dimensional display devices. The only exception will probably be the new technology of interactive holography currently being developed at MIT: Holovideo (www.media.mit.edu/people/lucente/holo/holovideo.html:2001).

TBM can be broadly classified into interactive and non-interactive. Video, computer animation and sound are mainly non-interactive, although sound can be processed in an interactive manner too; Richard Brown's Alembic (www.crd.rca.ac.uk/~richardb:1998), Markos Novak soundsculptures (2000), Char Davies' Osmose (1997), etc. Virtual Reality on the other hand is a genuinely interactive medium.

Spatial representations are considered essential for analysing and communicating a wide range of environments, which can be classified in four distinct categories. With reference to their scale, represented environments could either be:

- ***Small objects:*** sculptures, artistic and real consumer products (QTVR, videos, aural descriptions, analyses of a variety of products ranging from personal digital organisers all the way to shoes, clothes and cars).
- ***Buildings:*** most TBM analyses focus on the way that a building is integrated within its context rather

than its interior in an attempt to evaluate its impact to an existing landscape/urban space.

- ***Urban scale spaces:*** rare due to the amount of expertise, resources, time and of questionable utilisation potential (examples Abacus, Bath, London, Helsinki, US cities, Canada, etc).
- ***Landscape models:*** which have widespread use in cartography, surveying etc.

As suggested before, we need TBM to represent space. We may use such representations:

- To record and analyse existing environments
- To visualise environments for evaluation purposes during the design process
- To visualise environments the design of which has been completed, for communication purposes
- To create artificial environments, which can only be experienced as spaces through this medium.

Courses integrating time-based media: case studies in Greece

In this section, examples of spatial representations utilising TBMs in the architectural, planning and surveying education curriculum of Greek Universities are demonstrated and a very short report on their teaching practice is provided. Three cases of engineering departments have been selected, each of them corresponding to a different environmental representational scale, according to the previously defined categorisation. More specifically:

- At the landscape scale, some geomatics activities in NTUA are presented and the theoretical level use of media within these activities are explained
- At urban scale, the planning and architecture courses in UTH are presented and the use of video and audio at a more advanced level is described
- At a building level, the department of architecture of NTUA is presented and the use of 3D graphics for architectural visualisation and animation is described.

Geomatics activities at NTUA

Geomatics (or surveying engineering) activities at NTUA take place within the undergraduate and doctoral research activities of the Department of Rural and Surveying Engineering, as well as, in the interdisciplinary post-graduate Geoinformatics Programme. Geomatics education by nature involves various methodologies related to the dynamic representation of space. By the general term "representation" we do not strictly imply visualisation, but also *perceptual* and *cognitive* issues about space. These are necessary before one decides what abstract model of reality to select and what data shall materialise such a model. The majority of problems address space from the scale of 1/500 (large scale) to the scale of 1/100.000 or smaller. Special course projects (e.g., in close-range photogrammetry) address space at the much larger scale of a specific object, e.g., building or monument. Both rural and urban space is addressed.

Currently, TBM are mostly employed in several undergraduate diploma dissertations, graduate work and research projects. So far, TBM have been rather resource intensive and not very easy to introduce to large audiences, given also the fact that almost all courses already use extensively the available computer facilities. With the wide-spreading of low-cost TBM however, it is foreseen that they will infiltrate the undergraduate curriculum in the near future.

In geomatics, TBM consists of specialised – often very complex – hardware & software systems to represent dynamically static or dynamic spatial phenomena. Actually, dynamic representation of dynamic spatial phenomena constitutes in itself a difficult topic for it is supposed to deal not only with sophisticated media but also with spatio-temporal database issues. Levels of abstraction, granularity, generalisation, interpolation and the like apply to both space and time and need to be represented as such. In this context, various traditional scientific domains experience the necessity of incorporating TBM (3D visualisation and interaction, video, multimedia, animation, real-time GPS-GIS integration, dynamic maps and finally virtual environments).

Two such fields have been selected here to illustrate the need and usage of TBM in geomatics: *Cartography-GIS and Spatial Data Fusion.*

Cartography - Geographic Information Systems (GIS). This field uses the sound cartographic theory on abstraction, symbolism and visual variables to represent landscapes and associated geoinformation using standard 2D/2.5D/3D cartographic visualisation including relief shading (International Cartographic Conference ICC'2001, www.sbsm.gov.cn/icc2001/ :2001). Also covers the issue of cartographic generalisation (i.e., the ability to produce smaller scale representations from larger ones). TBM have been necessary for depicting routes and views on/of the landscape. These can be animations of pre-selected scenarios (e.g. weather maps, life and motion of socio-economic units) or interactive systems where the user flies over and around the landscape. The introduction of dynamic 3D visualisation has eased some perceptual difficulties of standard static representations, e.g., shading or visibility, but has drastically changed the theories on visual variables. Also, zooming in/out requires different levels of spatial and thematic resolution. These problems are dealt with at the graduate level, where the audience has the size and maturity to consider cognitive aspects of geographic space, spatialisation and the use of virtual environments (VEs) to represent (a) real or imaginary space or represent spatially aspatial information (in large databases, data mining), i.e., making sense of very large datasets.

Spatial Data Fusion. From the educational point of view, it is very important that students learn to integrate different methodologies, data and TBM in order to achieve the goal of modelling, visualising and interacting dynamically with representations of geospace (International Symposium on Digital Earth Moving, www.cimsi.cim.ch/dem2001:2001). Real time referencing and positioning using GPS technology is extensively used to accomplish this. Students get this opportunity during surveying camps or special interdisciplinary courses. More advanced integration may take place at the graduate level where students combine and represent in real-time data from video and GPS, integrate with existing map data, aerial photography, remote sensing imagery and attribute tables. The new data feed a GIS database and the result of an accurate, but more importantly meaningful, integration can (and has to) be visualised only dynamically (Commission on Visualisation and Virtual Environments, www.geovista.psu.edu/icavis/:2000). TBM besides its own usefulness in spatial integration, gives students the opportunity to think holistically and co-operatively, and follow a problem-oriented and not discipline-oriented approach.

Planning and Regional Development at the University of Thessaly

The course presented is a second year studio on "The Structure of Space in Everyday Life: From the History of Ideas to the Image of the City". The aim of the course is to train students into "seeing" and feeling the city around them, analyse events, criticize processes and familiarize them with digital presentation techniques.

Following, students work in groups and investigate, analyse, and present a 20-minute multimedia "show" on predetermined areas of the city of Volos. Students analyse existing conditions, research on historical data, document events happening in the duration of the project, happenings that had a knock on effect on their area and the ways these events have affected the area under investigation. Main source of visual material is their own photos complimented by documentation collected from old photos, books, planning offices, Municipality's historic archive, etc. However, attempting to document urban life with static images is restricting and students resort to video and audio. The final presentation is of a TV documentary format, with historic data, tabulated information, photos etc. on video projection whilst the students present their arguments live to a large audience. Voice recorded interviews that support their scenario together with edited video compliment their presentations.

The educational outcome is twofold. On the one hand sensitise the students into experiencing, understanding and analysing the urban structure that surrounds them, on the other teach them basic techniques in presenting their ideas on a large audience, and familiarise them in using digital technologies.

Architecture at the UTH

TBM are introduced early on, during the first year studio work in the Department of Architecture. Together with the typical design studio project, students are asked to create a 3-minute video, drawing experiences from the city they live and study, Volos.

The aim of this exercise is to force students into a structured series of mental exercises: the analysis of the event / activity / condition they want to film, understanding space as the setting on which everything takes place, shaping this existing space according to their needs, lighting, building an appropriate scenario, etc. Photographs and sketches are used in the interim submission of the storyboard.

Throughout the semester, members of staff (film directors, animators, artists, etc) give a series of lectures on cinema, scenario design, storyboards, camera movement, montage etc. The Laboratory of Environmental Communication and AudioVisual Documentation (LECAD) provides the facilities for the students to digitise, edit, and output their work on VideoCD which are then presented at the end of year show.

Architectural courses at the Department of Architecture – NTUA

Several courses at an undergraduate and postgraduate level make use of computer-based tools for 3D modelling and for generating animations of designed environments. At an undergraduate level a course titled “Approaching environmental perception through static and dynamic computer based representations” aims at developing skills for creating legible, functional and aesthetically satisfactory architectural visualizations and animations, for the purpose of presenting and communicating the resulting architectural design. More specifically, students experiment with the use of colour, transparency, and texture in static visualizations. They are also presented with certain basic elements of cinematic theory, principles and techniques for enhancing the design of animations. Thus they begin their own subjective elementary investigation into the use of these tools for providing time-based spatial representations, which communicate a certain intended sense of space.

At a postgraduate level, the course titled: “New tools towards understanding and aiding environmental perception” aims at studying ways in which 3D modelling and animation techniques can support the analysis and evaluation of certain designed environments and ultimately provide an enhanced perception of these environments and better appreciation of their spatial qualities. The parameter of time is considered as essential for simulating the experience of moving within an environment or certain phenomena, which evolve through time.

During the initial phase of the course, students familiarize themselves with 3D modelling and animation techniques. In the second phase, they design a relatively small urban scale model (a street and its surrounding buildings in Athens), which will act as the field for their case studies. During the final phase, teams of 2-3 students conduct studies, which aim to investigate environmental attributes and properties of the particular street that has been selected. In these studies, static visualizations and animations have been used for analysing existing conditions or for evaluating possible design proposals to improve the environmental character of the street. These studies evolve along the following directions:

- Investigate the way that the sunlight and the movement of the sun influence the environmental image we perceive when walking along the particular street

- Test alternative possibilities for creating abstract visualizations and consequent animations of the street for providing certain intended senses of space
- Study the way that certain environmental characteristics (position, light intensity of sun, colour of sky, fog etc.) alter the street's sense of space all throughout the year
- Use a series of static and dynamic visualizations for evaluating certain design proposals, which aim to integrate existing environmental elements with minor addition of light structures and street furniture.

Conclusions - Future work

This paper has attempted to justify the introduction of time within spatial representations as an essential parameter for describing and simulating the spatial experience. Consequently the use of TBM has also been considered essential for creating such representations.

Concluding from cases presented above, it is suggested that the use of time-based media within certain curricula of engineering departments in Greece has been successful so far. It is understood that since these media have only been used in these courses during the last three years, their integration within the learning process needs to be carefully studied and resolved. Additionally, the need for specially trained personnel is apparent since teaching and studio work relating to time-based media may require specialized expertise and skills from the areas of cinema, video production, animation, simulation technologies, etc.

Finally, relations amongst presented courses can be established, leading to possible cross-university collaborations and greater integration in the near future.

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