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Real-time porosity using computer gaming technology

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ABSTRACT

'Porosity' describes the publicly accessible spaces within privately owned parts of the city. Any mixed use building is necessarily Porous; for example, clients must be able to visit their dentist's surgery on the 14th floor, their lawyer on the 5th floor, or a restaurant on the roof. A building's porosity is a measure of the quantity and quality of pathways to a given destination. The authors have developed and tested two prototypes that translate the movement of a person in the real world into the virtual environment of a computer game; note that the pedestrians' participation is entirely passive (i.e., they are not knowingly playing a computer game; they are simply going about their business). The movements of a Non-Player Avatar, standing in for the pedestrian, are then represented with a range of textures, geometries and behavior. The authors call these representations of movement and time 'Porosity Lenses.' In one lens the movement of the avatar constructs a facsimile of a space as sensors passively capture a person's movement through the real one. The paper compares the lenses developed with recent representations of movement over time to highlight strengths and weaknesses of the approach. Finally, the paper describes preliminary testing of the system within a scientific research facility.

1. Introduction

A growing list of urban mapping projects suggests there is an urgent need for a deeper understanding of the dynamic relationship between public access and the inhabitable spaces of the city (see Reades et al. [1], for a representative range of these, Nold's [2] work is worth a special mention). In many cases these projects represent dramatically changing patterns of use, mobility, and security. The term *Porosity*, coined by Richard Goodwin [3], describes the publicly accessible spaces within privately owned parts of the city. With the support of an Australian Research Council Discovery Grant from 2003 to 2005 Goodwin and his research team mapped these *Porous* spaces within the Sydney Central Business District. The results suggest new opportunities for pedestrian movement through the city. In contrast to many of the urban mapping projects cited above the *Porosity* maps are fully three dimensional. By recording the member of the public's duration of stay they also capture the dimension of time. However, due to the manual data gathering techniques employed, the first incarnation of the *Porosity* maps were only able to create a snapshot of the buildings selected. To understand how the *Porosity* of a specific building might change over time the mapping process would need to be automated. This prompted questions such as; can *Porosity* be represented over time, and ideally in real time? What should that representation look like? Can the combination of computer gaming technology and environmental sensors automate the representation of *Porosity*?

In this paper the authors describe a new way to map the *Porosity* of a building by modifying off-the-shelf computer games and using sensor controlled Non-Player Characters (NPCs). In a typical single player computer game the player knowingly controls an avatar (which is the player's embodiment within the virtual world) and may compete against or be assisted by NPCs that are controlled by artificial intelligence. In a multiplayer game the player is usually competing against or being assisted by avatars that are knowingly controlled by other real people. See Bartle's [4] *Designing Virtual Worlds* for further information and clarification. In contrast to these typical situations the authors have created a prototype where a real pedestrian's presence in the virtual environment is entirely passive, i.e., they are not using the computer or knowingly playing a computer game, they are simply going about their business. This also contrasts the Gemeinboeck et al. [5] approach where the space of the game develops in an interplay between the player and their avatar. To clarify this distinction the authors have coined the hybrid term *Non-Player Avatar* (NPA). The movements of a NPA are driven by sensors recording a pedestrian's movement within a real environment and simultaneously traced in virtual space and time with a range of textures, geometries and behavior. The authors call these representations of movement and time *Porosity Lenses*.

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