Sensitive suggestion and perception of climatic effects in virtual urban environments

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Sensitive suggestion and perception of climatic effects in virtual urban environments

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1 Introduction

Climatic effects represent the physical signals (temperature, wind, humidity, light) which can have a perceptual impact for human-beings. They significantly influence perception and use of urban spaces. Nevertheless, while virtual environments have been proven as good tools to assess urban projects by non-expert people or to study perception in cities, climatic atmospheres are very seldom integrated in the virtual urban model [Drettakis et al. 2007; Tahrani and Moreau 2007]. Indeed, virtual urban environments are represented in ideal situations: the sky is blue, there are a few white clouds, trees are leafy or flowered and the sun is shining. Thus, participants can rarely experiment various seasons, times of day or weathers and and evaluate the urban design under different climatic or lighting situations.

To address these issues, it is necessary to find perceptually valid means of suggestion to delineate climatic effects in virtual urban environments. These means of suggestion must create multisensory climatic effects in sensitive, immersive, real-time and non-costly ways. Therefore scientific visualizations of climatic features are eliminated because they are difficult to understand for public and not really immersive. Moreover, we focus on immersive audio-visual virtual environments. Indeed, devices attempting to reproduce physical stimuli of climatic effects are ruled out because they are too expensive, impractical to use and have not been validated in a perceptive way yet.

2 Methodology & Experiment

The research question is: how to induce multisensory climatic effects by using only audio and visual inputs in a virtual environment and how are they perceived?

To our knowledge, very few studies include the perception of climate or weather in immersive virtual environments except Houtkamp et al. [Houtkamp et al. 2008] who studied the impact of dynamic and audio effects on the perception of a stormy and rainy weather in a virtual landscape. In this poster, we present at first a new methodology to suggest climatic effects in audio-visual environments based on high-level perception and artistic skills to create

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sensitive and affective impressions. Thanks to this methodology we identified various visual means of suggestion to provoke climatic impressions (color ambient light, saturation, white sharpen edges, blur, clouds and leaves movement) and we conducted a perceptual experiment (Figure 1a), the results of which are presented and discussed here. Sound effects have not been studied yet (a soundtrack was implemented to increase presence feeling during the experiment but no suggestive sounds of climate were added). This experiment consisted in the evaluation of 10 climatic variations of a single virtual urban environment (Figure 1b). Each variation represented a unique combination of visual and dynamic effects to evoke a special climatic situation. During the experiment, 42 participants evaluated all the 10 climatic variations. For each of them, they were first asked to assess temperature, light, wind and humidity on Likert scales. Then, they had to pick the most relevant items among a set of words or locutions relative to season, time of day and weather.

3 Results & Conclusion

We identified interesting visual and dynamic effects for climatic suggestion and some perceptual or cognitive mechanisms involved in perception of virtual climate (interactions, memorization, projection). Nevertheless, other experiments have still to be done to improve our knowledge of climatic perception in virtual immersive environments (objectification of visual effects, impact of sounds, characters or urban morphology, etc).
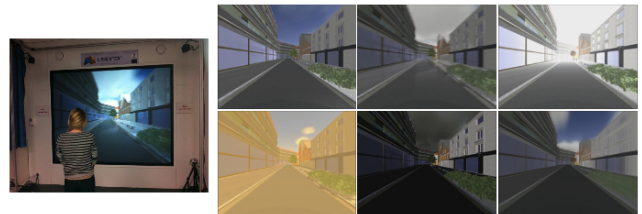
Figure 1: *(a) The perceptual experiment. (b) Snapshots of six climatic variations.*

References

DRETTAKIS, G., ROUSSOU, M., RECHE, A., AND TSINGOS, N. 2007. Design and Evaluation of a Real-World Virtual Environment for Architecture and Urban Planning. *Presence: Teleoperators and Virtual Environments 16*, 3 (June), 249–332.

HOUTKAMP, J., SCHUURINK, E., AND TOET, A. 2008. Thunderstorms in my Computer: The Effect of Visual Dynamics and Sound in a 3D Environment. In *International Conference Visualisation*, IEEE, 11–17.

TAHRANI, S., AND MOREAU, G. 2007. Analyzing urban daylighting ambiences by walking in a virtual city. In *Proc. IEEE Virtual Reality Conf. VR '07*, 227–230.