**VR4Green: an Immersive and Interactive Virtual Reality Experience for Climate Change Education**

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# VR4Green: an Immersive and Interactive Virtual Reality Experience for Climate Change Education *

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## 1  Introduction

The climate crisis has become one of the main challenges of the 21st century [2]. One of the hardest aspects of facing global warming is the difficulty of people to perceive the importance of their personal impact on the environment due to long-term consequences. In this scenario, it is crucial to educate people to adopt pro-environmental behaviors. Virtual Reality (VR) has frequently and effectively been used as an educational tool to change people's behavior on a variety of topics, including climate change awareness. In recent years, several projects focused on promoting and teaching pro-environmental attitudes and strategies through VR. However, the majority of these projects focus on only one specific aspect of climate emergency, such as waste-sorting [4] or dietary footprint [3], or consist in 360° videos [1]. We propose a native interactive VR experience that takes place in the city of Torino, to educate and promote pro-environmental behavior in people's everyday lives. The current work presents the main outcome of analyzing which visual effects within the VR application evoke the most intense emotions in the users.

## 2  Project description

We defined two main scenarios in which the experience takes place. Firstly, to make the experience feel relevant and familiar to participants, we created a virtual reproduction of the city center of Torino (Figure 1a). Secondly, we modeled a virtual house with furniture and household appliances (Figure 1c). The behavior of the user in the home and their interaction with household appliances produce changes in the surrounding environment, for better or worse. We developed different visual effects in the outside virtual environment to simulate the worsening of environmental conditions (Figure 1b), which directly depend on

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(a)                                    (b)                                    (c)
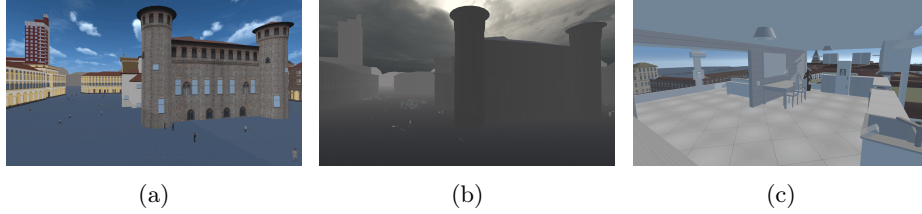
Fig. 1: Virtual reproduction of the city center of Turin in good environmental condition (1a), Turin affected by climate change (1b) and the virtual room in which user can interact with furniture and household appliances (1c)

the user's interaction with objects in the room. Specifically, we incorporated the following visual effects into the experience: *pedestrians* coughing and collapsing to the ground, a pervasive *smog* enveloping the landscape and obscuring distant buildings, scattered *trash* and garbage surrounding the city, *building* facades becoming dirtier due to smog, a gradual decrease in *river* water levels, *birds* falling to the ground and *trees* losing their leaves over time.

The aim of the project is to increase participants' awareness of their individual impact on climate change by reducing the temporal gap between their actions in the room and their corresponding consequences on the environment. As our intention is to adopt an emotional learning approach rather than a cognitive one, this paper presents a preliminary study aimed at identifying the visual effects within the application that induce stronger emotions in users.

## 3    Discussion and Conclusion

We recently run some preliminary user experience tests on the virtual environment of Torino, and collected positive feedback on graphics, sounds, and interaction design. We evaluated the users' perception of the visual effects that compose the dystopian environment through subjective and objective data, and defined participants' emotional responses to several critical situations (collected through PANAS questionnaire [5]). In particular, we grouped the visual effects in three different sets, categorized by their target impact: *human effects*, which impact on man (*pedestrians, smog*); *urban effects*, which relate to urban environments (*trash, buildings*); and *naturalistic effects*, which are connected to nature (*rivers, birds, trees*). We then divided PANAS questionnaire into positive and negative emotions. Results suggest that the naturalistic effect caused the highest negative emotional impact, while human effects lead to unexpected positive emotions.

We are currently testing how much the room environment affects users' attitudes towards environmental problems, and how the cause-effect relationship between actions within the room modifies perceptions of a catastrophic future.

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