Comparing Abstract and Realistic Agent-Led Instructions for Language Learning in Virtual Environments: A Study on Presence effects

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***Abstract*—Objectives: This study investigates the impact of virtual agent realism in immersive Virtual Reality (iVR) on foreign-language vocabulary learning. Specifically, it compares the effectiveness of a realistic (human-like) pedagogical virtual agent versus an abstract (non-human-like) one in delivering instructional content.**

Methodology: A between-subjects experiment was conducted with 17 participants, divided into two groups, were exposed to either the realistic or abstract agent in an iVR Search-and-Find vocabulary learning task. Learning outcomes were measured using pre- and post-tests (based on word matching translations for 10 German-Portuguese item pairs), while presence-related experiences were assessed via the Igroup Presence Questionnaire and Temple Presence Inventory.

Results: Both groups demonstrated significant vocabulary acquisition improvements. However, no significant differences were found between the realistic and abstract agent groups in either learning outcomes or presence scores.

Conclusions: The findings suggest that the visual realism of virtual agents may not significantly influence language learning effectiveness or user presence in these iVR environments. These preliminary results imply that abstract agents could be as effective as realistic agents for this type of foreign-language instruction, potentially reducing development resources without compromising learning benefits.

***Index Terms*—Foreign Language Learning, Virtual Reality, Virtual Agents, Presence, between-subject study**

I. Introduction

Immersive Virtual Reality (iVR) has emerged as a transformative technology with the potential to revolutionize how we learn and interact with digital content. At its core, iVR offers a simulated experience that is not constrained by real-world limitations, allowing users to experience different scenarios from anywhere. This technology allows us to engage with immersive three-dimensional environments in real-time, providing a heightened sense of presence that traditional digital learning platforms often struggle to achieve [1].

The sense of Presence is a psychological state that occurs when a virtual environment successfully evokes the sensation of being in a physical space. This experience can be characterized by the feeling of being "there" [2, 3], coupled with perceived realism [4]. Also known as subjective realism, perceived realism is a critical component of various presence evaluation instruments. It assesses the extent to which the virtual experience is perceived as realistic and consistent with users' real-world experiences [5, 6]. Presence is one of the most extensively studied metrics in iVR, which serves as a benchmark for evaluating iVR applications [7, 1, 5]. Presence can be further categorized into concepts like "Social Presence", which represents the perceived "realness" of other virtual individuals (Virtual Agents) sharing the virtual space, Spatial Presence, depicting the sense of being physically within the virtual space, and Involvement, the level of engagement with the experience [8, 9, 10, 11].

One potential application of iVR and its ability to evoke a sense of presence is in education, where, for example, students can visualize and learn complex concepts in a 3D space. It has shown good potential to increase learning outcomes [12]. Besides visualizing complex concepts in 3D, iVR has proven to benefit foreign-language learning [13, 14, 15, 16]. Taking advantage of the fact that we learn better by doing, iVR allows students to become present in locations depicting foreign countries and cultures, which they can learn by "directly" contacting situations where they would use such language skills.

By simulating realistic scenarios and social interactions, learners can practice language skills in contexts that closely mimic real-life situations. This approach enhances student engagement and motivation by providing an interactive platform where learners can actively participate and experience the material rather than merely observing and listening. Additionally, it promotes complex learning [17, 18, 19].

Since foreign-language learning involves interactions with others, perceiving Virtual Agents as realistic and integral to the scenario and context can be important. The term Virtual Agent is usually reserved for virtual entities that are controlled by the computer, while avatars are representations of real individuals in the virtual world [20]. Virtual Agents often appear in video games (commonly known as NPCs or Non-player characters) and other virtual worlds that function as social interfaces, such as in online customer service [21, 22]. Additionally, virtual agents can be categorized based on their visual characteristics [23], ranging from realistic agents to more abstract ones, where human traits are minimized (such as lack of gaze and human form). In the field of education, a pedagogical agent is a type of Virtual Agent that supports the learning process

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