

# Investigating the Role of AI Non-Player Characters in Virtual Reality

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This paper presents a preliminary investigation of Virtual Reality (VR) environments with Artificial Intelligence (AI) Non-Player Characters (NPCs). The objective is to explore the potential of natural language interactions facilitated by the NPC to inform and engage users within a virtual environment. Two scenarios were created: (1) Meiji Japan and (2) PC Construction. By examining the efficacy of AI-enabled NPCs this investigation contributes to our understanding of leveraging Artificial Intelligence to enhance educational achievement and user engagement within future VR learning environments.

CCS CONCEPTS • Human-centered computing • Human computer interaction (HCI)

## INTRODUCTION

**Purpose of the Research:** The aim of this exploratory research is to determine if AI-enabled Non-Player Character (NPC) interactions with a human learner in Virtual Reality (VR) alleviate cognitive workload and subsequently support successful learning.

**Definition of the problem:** The rhetoric on NPCs in VR suggests that they facilitate engaging and immersive virtual experiences, and are expected to become a valued component of educational and gaming VR environments. However, research is required to fully understand their potential and how to design them effectively.

**Proposed solution:** There is significant interest in research on Virtual Reality and the integration of Artificial Intelligence (AI) to enhance the immersive experience and enable virtual agents and avatars to exhibit human-like intelligence. At the forefront of AI development is OpenAI. For instance, GPT (Generative Pre-trained Transformer) is an unsupervised transformer language model; essentially an algorithm that learns patterns from untagged data, builds a subsequent representation of its world, and then generates content. This form of meta-learning has led researchers at OpenAI to experiment with AI by releasing conversational interfaces such as ChatGPT allowing dialogues in natural language. Similarly, through Natural Language Processing capabilities AI-enabled NPCs interpret user input (text and speech) for realistic dialogues with a human interlocutor.

The next section summarizes the development of two VR scenarios for investigating the role of AI-enabled NPCs.

## IMPLEMENTATION

**Meiji Japan:** An unexpected encounter with historical artifacts concealed among the mountains of Hakodate was

the inspiration to unearth more about 19th century Japan and provided an opportunity to shed light on this forgotten heritage (see Fig. 1). Isabella Bird's journey from Yokohama to Hokkaido in 1878 provided informative insights to the life of rural Japanese. She witnessed economic hardship and poverty, with families in rural Japan living in impoverished conditions and lacking medical facilities and formal education. In Hokkaido she encountered discrimination against the indigenous Ainu people. Due to the unique characteristics of AI-enabled NPCs to enable more dynamic, interactive, and immersive experiences in virtual environments, their ability to enhance user engagement, an Isabella Bird NPC was created with core descriptions, motivations, emotions and personality. Initial facts and knowledge were also programmed into the Isabella Bird NPC, along with a preferred voice characterized by varied pitch and speed. Furthermore, the dialogue style of the NPC was customized, with options including blunt, bubbly, formal, or inquisitive. These settings allow for the creation of highly personalized NPCs, each with its own distinct characteristics. For example, a blunt NPC provides straightforward answers to questions, while an inquisitive NPC engages in off-topic interactions to further enhance engagement (cf. inworld.ai). The NPC character as Isabella Bird (see Fig. 2) responded to spoken questions, specifically assisting human participants in their search for information related to 19th-century Japan. The AI-enabled character's presence adds an interactive element, allowing for dynamic exchanges with the human interlocutor and supporting their exploration of the virtual environment. A Virtual Heritage environment of a 19th century Japanese town was built in the Unity application to access via a Quest 3 VR head-mounted display (see Fig. 3). Through the use of pre-fabricated models, strategically placed objects, personalized NPCs, and additional Meiji-period AI characters Fukuzawa Yukichi and Takayoshi Kido participants are provided with a rich and engaging

experience, facilitating their exploration and discovery of information specific to 19th-century Japan interactions, and provide a greater sense of realism within Virtual Reality.



Fig. 1. Monuments of Emperor Meiji and Isabella Bird visiting Onuma in 19<sup>th</sup> century.



Fig 2. AI-enabled NPC Isabella Bird



Fig 3. 19<sup>th</sup> century Japanese town created with Unity and viewed in VR

**PC Construction:** It has been long established that people construct meaning and knowledge through experience. An interactive VR experience with the goal of constructing a Personal Computer (PC) was developed to facilitate procedural knowledge. The design considered interaction, immersion, user participation and photorealism. An open lab was constructed within Unity and 3D components of a PC such as a motherboard, RAM, SSD, CPU, GPU, fan, and a power cable were imported. After that, the interactive process of building the PC was programmed in a specific procedural manner. The Unity Project was then customized to operate in VR using the Oculus Rift HMD and its associated hand controllers. Personalized support from an

AI-enabled NPC named Bob was provided by a customized avatar (inworld.ai). Bob's character setting were quite different to those of Isabella Bird. As a knowledgeable computer instructor whose role was to support the user in constructing a PC from give components the personality, voice and dialogue settings had to be more akin to a patient school teacher encouraging the user through motivational prompts but strict procedural actions. Responding to spoken questions, Bob specifically supported the human interlocutor in building a personal computer. If successfully constructed, the PC could be turned on and the Windows chime heard.

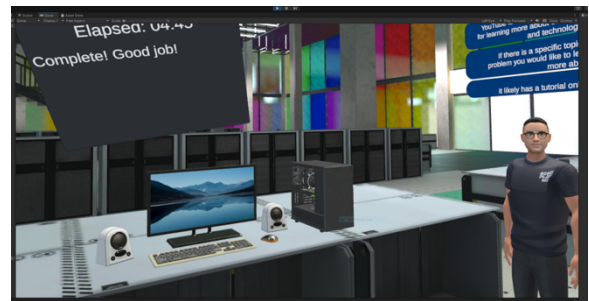


Fig 4. AI-enabled NPC Bob

## CONCLUSION

In undertaking this investigation it was observed that AI-enabled NPCs in VR can enhance storytelling and realistic engagement, providing background and detailed time-sensitive information, and subsequently react in real-time thereby adding narrative depth to the VR experience. The NPCs also adapt to the user's capabilities, providing suitable feedback and assistance as the user progresses declarative knowledge (e.g., Meiji Japan) and procedural knowledge (e.g., PC Construction). Furthermore, the NPCs encourage additional interactions often unassociated with the core learning task leading to an enhancement of emotional engagement and a state of flow with the VR experience; in other words, users can become completely immersed and forget they are not in an actual physical environment.

## PUBLICATIONS

[1] **Vallance, M.** (2023). Independently Supporting Learners in VR with an AI-enabled Non-Player Character, Proceedings of the 9th International Conference of the iLRN, San Luis Obispo, California, USA, DOI:

<https://doi.org/10.56198/ITIG2WMWY>

[2] **Vallance, M.** (2023). Virtual Heritage & AI: Learning about 19th Century Japan with Isabella Bird. Paper presented at the 7th Education and E-Learning International Conference. Tokyo, Japan.