



Mystery of the Lehigh Gap: Summary of the Visual Aspects Designed and Developed for the Dialogue System for Desktop VR Game

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Abstract. This paper shares the design and development process of the dialogue system for the desktop Virtual Reality (dVR) game "Mystery of the Lehigh Gap". Additionally, it outlines design choices as a means of increasing the immersiveness of gameplay including: creation of game characters (avatars), visual representation of roles, use of authentic local media, and incorporation of adapted historic cartoons and photos.

Keywords: Game-Based VR, Game Design, Dialogue System, Visualization, Non-Playable Characters (NPCs).

1 Introduction

The Virtual Reality (VR) game "The Mystery of the Lehigh Gap", explores the historical changes around the Lehigh Gap area, Pennsylvania, USA due to a zinc smelting plant from the late 19th to the late 20th century [1]. The game is based on real historical events, sites, and timelines. The purpose of this paper is to share the design and development of the dialogue system for the desktop virtual reality (dVR) version. The game provides learners with immersive gameplay through a series of mini-games that incorporates historical content knowledge and is designed to engage one's emotional connection to the materials [2]. Throughout our design and development process, all visualization elements of the game go through an iterative process with input from our partners, including a local historian, to ensure that the visual elements of the game are authentic to the different time periods depicted.

2 Visualization

Historical figures drive the game narrative forward with their dialogues throughout the game. These non-playable characters (NPCs) avatars present the content knowledge for learners and the historical context of each visited location or activity performed (for example, mineral resources mining, transportation, and zinc smelting). Additionally, historical postcards and photos were used as background imagery for dialogues and mini games. Three different styles of dialogue boxes were designed to assist learners with identifying and recognizing the game's main stakeholders (i.e., the learner/the player, the narrator, and the NPCs).

2.1 The Avatar Creation Process

The avatar prototypes were developed in Procreate [3]. One prototype followed a modern anime style. The other mimicked political cartoons of the game's era, using shading methods including hatching and cross hatching to create depth and dimension, and a sepia tone to replicate the look of an old newspaper. Our development team ultimately decided to move forward with an anime style avatar with the shading/colors of the historical avatar. This blend of styles provides a nod to history while retaining the potential to appeal to a younger audience. All

avatars in the game were based on people in historic photos provided by the team’s community partners, with a total of seven different historical characters, including two authentic figures.

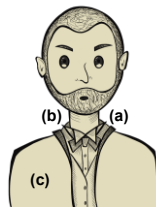


Fig. 1.



Fig. 2

Note: Stephen Palmer’s avatar (Fig. 1) was based on his original portrait/photo (Fig.2) [4]. (a) cross-hatching, (b) hatching, and (c) sepia tone

2.2 Representing Different Roles Visually

Three different narrative components were designed to draw learners into the game, including the role of the narrator, the player, and the avatars. The narrator provides instructions, hints, and storyline progression from an omniscient perspective. The first person player character represents the learner themselves. During the narrative, the player often shares metacognitive prompts (e.g., “Now, where am I?”) to increase learners' engagement during gameplay. To provide a more immersive experience, the group devised contextual conversations between avatars and/or historical figures. These avatars display on both sides of the dialogue box to represent conversational turns. When an avatar speaks, their picture lights up and a voiceover starts while the other avatars fade into the background (see Fig. 3).

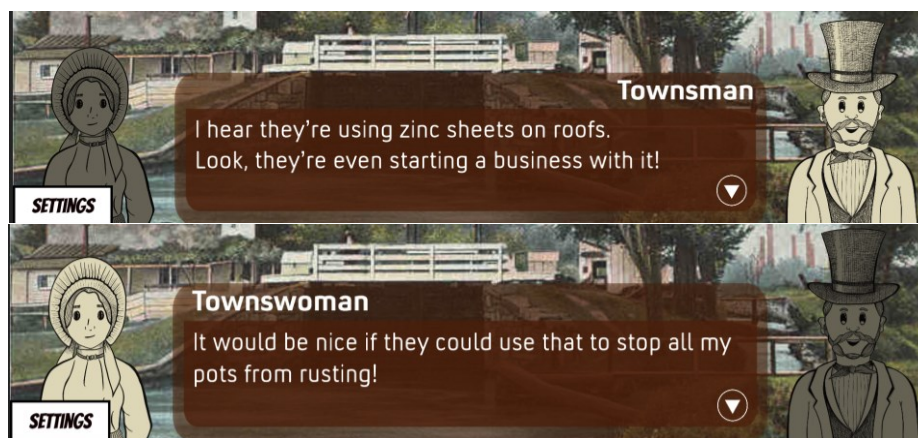


Fig. 3. Image showing dialogue between two avatars.

2.3 Localization with Authentic Media

During gameplay, newspapers communicate the time period and local contexts authentically (Fig. 4). After each time travel cutscene (i.e., time jumps), players find themselves in different periods of the game timeline. Thus, real local newspapers from those respective time periods are used as background along with a summary of the main events of the narrative. To develop these images, the Pennsylvania Newspaper Archive [5] was used to locate publications that may have been read in the Palmerton, PA area in 1845 and 1853. Additionally, a Bridgeton, NJ newspaper was used for the 1912 time jump, as it was in the vicinity of where the New Jersey Zinc Company originated. Photoshop [6] was used to manipulate the historic newspaper images, which entailed retouching archival photos, aging the paper photos using sepia tone, and adding text. Serif fonts that stylistically matched the newspaper were used for headlines while sans serif fonts were used for the articles text for accessibility purposes.

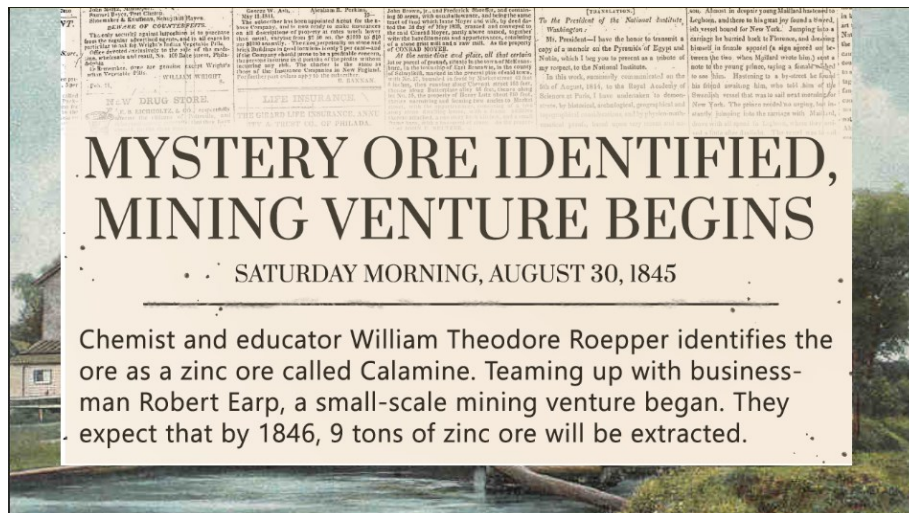


Fig. 4. Newspaper image.

A constant focus of the team's design choices was compliance with accessibility guidelines. For the dialogue boxes themselves, the team decided to use the Convection Condensed font as a nod to Microsoft Xbox entertainment system. This font also is appropriate from a readability standpoint, as it is sans serif [7]. To ensure cohesiveness of design, there is consistency in fonts across the game. All text is high contrast to ensure readability and colors align with our institution's branding and visual identity guide [8].

2.4 Adaptation of Cartoons vs. Realistic Media

Authentic historical photos and postcards were used for backgrounds of the dialogue scenes and puzzle games. AI was used to colorize monochromatic historical photos. Other images were retouched in Photoshop [6] in order to work compositionally with game components.

Postcards

Because the game entails time traveling to the past [1], postcards or paintings were selected to match the time period and location of the dialogue. The selection of historical postcards and pictures likely enhances the game's enjoyment and increases learner engagement. Compared to accurate historical pictures, images of postcards and paintings are of higher quality and are in color (see Fig. 5a).



Fig.5a. Vintage painting used for the background [9].



Fig. 5b. A panorama-style 360° photo of the Lehigh Gap Nature Center lobby.

Modern Photos

Authentic photos were also used to illustrate the storyline in the game's prologue and epilogue. In the prologue, the background picture is an image of the current Lehigh Gap Nature Center (Fig. 5b). The selection of an image of an actual location is designed to help learners recognize where they are during the gameplay: past or present.

A 30-second photo sequence conveys the major environmental change that occurred over the past two centuries at the Lehigh Gap and serves as the intro video for the game (i.e., before the main menu scene).

In the epilogue, we decided to embed authentic photos when players place missing pieces to fill the interactive diorama. These photos demonstrate the change in the area from 1845 - 2022. Players can compare the differences between the past and present under their direct visual implication.

3 Next steps

With multiple visualization designs, the dialogue system accentuates the time jump effect while increasing the immersiveness of gameplay. In addition to the visual aspect of the game, interactivity is another feature of the dialogue system, which will be described in another paper.

Author Contributions

Avatar creation, T. C. and Xy. H.; Narrative Scripts: Jy. Z., R.M.A.Jr., and Xy. H. Supervision, A.B., T.H., Zl.P., and R.M.A.Jr.; Project Management, R.M.A.Jr., A.B.; Visualization, T. C., Xy. H., and Jy. Z., R.M.A.Jr.; Writing—original draft, T. C., Xy. H., and Jy. Z.; Writing—review and editing, A.B., T.H., Zl. P., T.C., Xy. H., Jy. Z., and R.M.A.Jr. All authors have read and agreed to the published version of the manuscript.

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