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Demo: Mobile VR Site Experiences for Education in the Earth Sciences

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Abstract. A focus of our work is creating mobile educational VR site experiences for smartphones or low-cost standalone HMDs, suitable for a wide range of learning scenarios. Such experiences are of particular importance for Earth Science disciplines, such as Geography, Geosciences, Biology, and Ecology. In the demo session, we will showcase two of these experiences of real world places and demonstrate how they can be employed in different learning scenarios.

Keywords: Virtual field trips · SENSATIUM · Earth science education.

1 Introduction

The adoption of immersive technologies and associated experiences into classrooms is on its way [1]. However, this trend in immersive learning needs to be accompanied by both basic research [2,3] and studies in the wild [4]. ChoroPhronesis is conducting a wide range of VR and AR projects with the goal of (a) promoting the mainstream adoption of immersive learning environments and experiences into the day-to-day learning portfolio of instructors and students, and (b) of empirically assessing the benefits and effects of these experiences.

A focus of our work is creating mobile educational VR site experiences for smartphones or low-cost standalone HMDs such as the Oculus GO that allow for providing easy and low-cost access to the learning content to the masses and are suitable for a wide range of learning scenarios including individual learning, group classroom experiences, and multi-user experiences with remote participants. Such experiences are of particular importance for Earth Science disciplines, such as Geography, Geosciences, Biology, and Ecology. Providing virtual alternatives to actually visiting a place allows for reducing costs or risks, incorporating additional perspectives and simulations not available during the real visit, or re-living the experience as often as desired.

In the demo session, we will showcase two of these experiences of real world places (explained further in the following) and demonstrate how they can be employed in different learning scenarios. Participants will be able to try out and get hands-on experience with the two applications to get a better impression of the potential these kinds of VR experiences provide for immersive learning. We will also discuss some results from running empirical studies to evaluate these kinds of VR experiences.

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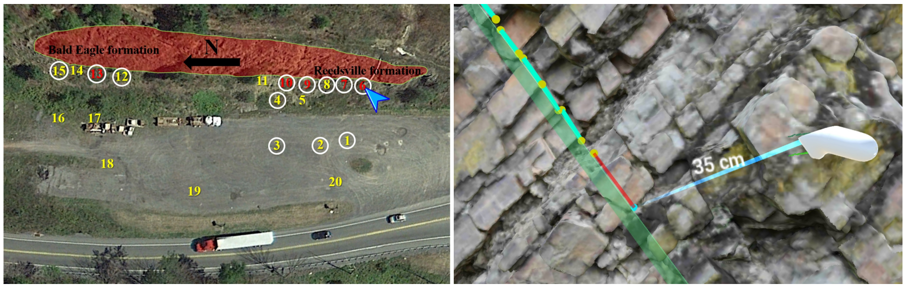

Fig. 1. Study area (Source: Google Maps) and interactive measuring.

2 Demo Application 1: A Geoscience Virtual Field Trip

Immersive virtual field trips (iVFTs) hold the promise to deliver access to a site almost independent of space and time. This particular mobile iVFT delivered through Oculus GOs leads students to the Reedsville and Bald Eagle geologic formations accessible through an outcrop about 12 miles from our university. We used a combination of 360° images and structure-from-motion photogrammetry to capture the field site digitally. Figure 1 (left) provides an overview of the Reedsville/Bald Eagle field site in the form of an aerial image. The numbers indicate locations where we took high-resolution 360° images. Locations indicated by yellow numbers allow users to experience the outcrop from an elevated perspective (27'/8.2m). Locations with a white circle include audio information. The blue arrow shows the location at which users have to measure the stratigraphy by accessing a 3D model of a part of the formation (see also Figure 1 (right)). Users can access essential details of the outcrop and additional information usually found in the field through interactive markers embedded in the 360° images and higher resolution photographs.

3 Demo Application 2: Joint Wildfire Ecology Experience

The Ishi Wilderness in California is one of the few contemporary examples of structurally restored old-growth ponderosa pine forest making it particularly interesting to wildfire ecologists and relevant for establishing fire and forest management strategies. The VR application we developed in collaboration with wildfire experts uses two different kinds of views (see Figure 2, two leftmost images): First, an overview map showing the locations of where 360° images, ground level and elevated ones, were taken. Second, upon selecting one of the locations, the user is instantaneously teleported into the 360° image view allowing for an embodied experience of the location while listening to audio comments by the experts. A visual guidance approach showing flashing circle markers and arrows helps with following which parts of the scene are being explained.

We enhanced the Ishi app with a multi-user VR component allowing several instances of the app to enter a joint session. To realize guided tours, the application can be set into 'Lead' mode or into 'Follow' mode. All scene/location changes made by the leading instance will be reflected by all instances currently in follow mode. We designed

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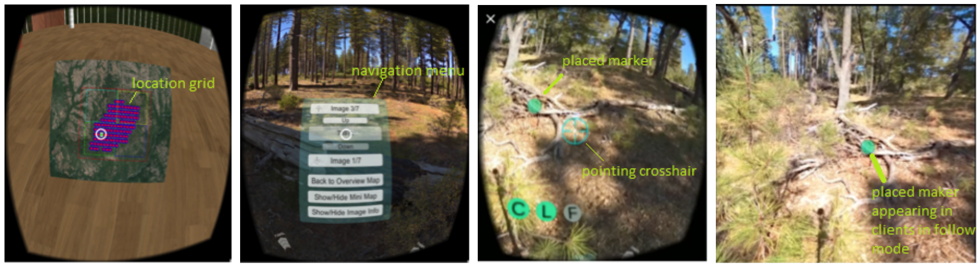

Fig. 2. Ishi app. Left: Overview and 360 view. Right: Lead and following client view.

a pointing approach (Figure 2, two images on the right) that allows for placing markers in the scene that will then become visible to the other users. This joint VR component allows for implementing scenarios such as teachers guiding their classes or remote students through the experience, or experts informing a group of decision makers.

4 Demonstration Details

We will provide several Oculus GOs for this session. After a demonstration and overview of the two applications, participants will be able to put on GOs and try out the applications themselves including the different roles in the joint version of the Ishi Wilderness application. We will continue with a discussion of the impressions and wrap up with a brief report and further discussion of insights we gained from running empirical studies with the iVFT application.

We hope that the demonstration and hands-on part will inspire new ideas and a productive discussion on novel ways to employ VR site experiences in Earth Sciences education programs and how to evaluate the effectiveness of these experiences.

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