

Enhancing the Digital Heritage Experience from Field to Museum

User-Centered System Design of an Augmented Reality Tablet Application for Cultural Heritage

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I. OVERVIEW

As smartphones and tablets continue to pervade our daily lives, museums have turned to these devices as a new platform for engaging visitors with cultural heritage. However, the needs of the museum visitor are often overlooked when designing these applications. Researchers from CISA3 are beginning to address this problem by performing studies to gauge users' wants in both engaging with the interfaces of mobile applications and the affordances associated with their environment of use.

CISA3 has developed its own augmented reality tablet application, *ARtifact*, which intends to put a wealth of collected information directly into the hands of both researchers and the general public in a variety of contexts [1]. With *ARtifact*, users can examine metadata in museums as well as in the field at archaeological sites [2]; users are able to view both multispectral images of artifacts and annotated information pertaining to them in real time using the tablet's video see-through interface. Wishing to deliver an optimal experience that engages the user and enhances the discovery and learning process, we followed the methodology of cognitive design to refine *ARtifact*'s utility, based on contextual interviews for data collection and affinity diagrams for qualitative data organization and interpretation.

Interviews were conducted in three stages. The first round of interviews took place at the Timken Museum in Balboa Park, San Diego, shadowing the art museum's testing of a new in-house developed mobile app. For this initial round, twenty-three visitors were interviewed and observed as they made their way around the museum. The second round of interviews took place with two directors from Balboa Park looking into enhancing the use of technology throughout the park, providing access to findings on extensive prior visitor research that the park conducted in its many museums over the years. Finally, interviews and observational studies were conducted with seven visitors of a gallery featuring *ARtifact* and a set of paintings as its primary exhibit.

To better organize and analyze the acquired diverse data, an affinity diagram was created, which involved breaking down data into individual points followed by the organization of these points into coherent, structured clusters [3]. This process allowed data to be more easily interpreted and resulted in numerous insights about both the behavior of museum visitors and how to improve *ARtifact* specifically. Notably, we found that users prefer to investigate different details based on their specific interests, and that augmented reality interfaces should encourage this mode of free-form exploration. In response, *ARtifact* was revised to visually expose and explain available features more clearly, guiding the user and encouraging the combination of cultural context, iconography, and iconology with scientific exploration of the studied artifact. Applications such as *ARtifact* are creating a unique opportunity to interface science, technology, engineering, arts, and mathematics (STEAM), allowing cultural heritage to be actively experienced and explored.

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