Personal Situated Analytics (PSA) for Sensemaking in Recorded Meetings

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ABSTRACT

Applications in immersive environments have gained popularity for training, learning, and recreational tasks. Due to the increasing availability of sensors and data-capturing devices, research is extending the use of immersive environments to support visual analytics processes, including sensemaking and strategic immersion for interaction and task completion. In this work, we propose Personal Situated Analytics (PSA) framework to embed users into recorded meetings with support for multiple degrees of immersion in the Reality-Virtuality spectrum. Our proposed framework encompasses various stages such as tracking, data capturing, data cleaning, data synchronization, prototype building, and deploying the final product to end-user hardware. We evaluate this framework on a data analysis scenario between human subjects and a conversational AI agent. Our pilot study (n=12) using this framework compares user experiences when using two different devices: Hololens2 and Quest2.

ACM Reference Format:
Ashwini Naik and Andrew Johnson. 2023. Personal Situated Analytics (PSA) for Sensemaking in Recorded Meetings. In *The 36th Annual ACM Symposium on User Interface Software and Technology (UIST '23 Adjunct), October 29–November 01, 2023, San Francisco, CA, USA.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3586182.3616697

1 INTRODUCTION

Situated Analytics is a novel concept in HCI that involves the process of understanding, sensemaking, and decision-making through data representations organized in relation to pertinent objects, places, and persons [3]. This concept has gained interest from multiple research communities, including visualization, human-computer interaction, and augmented reality.

Through our research, we explore how embodied situated analytics can help in strategizing and sensemaking of recorded conversations in an efficient manner. PSA is an extended reality (XR) framework that combines embodied cognition and situated analytics for sensemaking in immersive environments and enables:

(1) Embedding individuals in recorded meetings in MR/VR
(2) Sensemaking in MR/VR
(3) Studying space usage & exploration patterns in MR/VR

UIST '23 Adjunct, October 29–November 01, 2023, San Francisco, CA, USA

ACM ISBN 979-8-4007-0096-5/23/10.
https://doi.org/10.1145/3586182.3616697

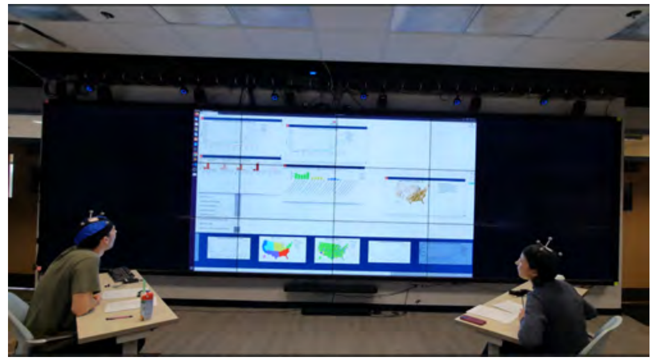

Figure 1: Two seated headtracked individuals interacting with Articulate+ [1, 2] during the data collection phase

Figure 2: A user embedded in a conversation using Personal Situated Analytics in Virtual Reality. It shows the same two participants from Fig. 1 represented as virtual avatars.

2 DATA COLLECTION

We captured 13 live conversations lasting approximately 60 minutes where individuals interact with Articulate+ [1, 2] an always-listening AI agent that can disambiguate requests and spontaneously present informative visualizations on an 18-screen tiled display wall. Their video, audio, screen usage, and head and body movements were captured. For tracking body and head movements the OptiTrack motion capture system consisting of 24 cameras was used. Markers were attached to the chairs of the participants and participants were asked to wear a hat with optical markers in order to track head movements. Out of the 13 datasets we chose the two best conversation datasets to be explored in our study one each for Mixed Reality and Virtual Reality sessions.

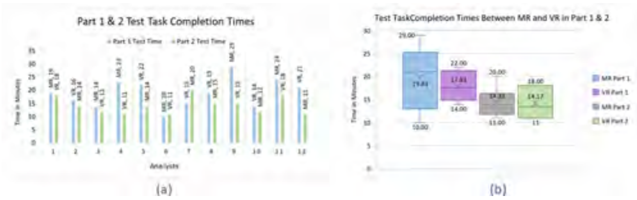

Figure 3: (a) Test Task Completion times for analysts in part 1 and part 2.(b) Distribution for test task completion times in MR and VR environments in part 1 and part 2.

3 EVALUATING PSA - USER STUDY

We designed a within-subjects user study (n=12) where the analysts used HoloLens2 in one part and Quest2 in the other part. The order of device usage was counterbalanced across users. The users could freely interact, explore and analyze a recorded conversation and understand the content of the conversation. We provide each user the opportunity to participate in the study using two different immersive headsets - HoloLens2 (MR) and Meta Quest2 (VR). The primary objective of the experiment is to evaluate the efficacy of using situated analytics to interpret recorded conversations. The user would explore different but related datasets using each of the two headsets.

Tools Used: Python, C#, Unity, MRTK, VRTK

Capabilities: Move to any point in time in the recorded conversation, toggle speech transcription, pause, replay, rewind and fast forward the conversation, select important attributes in the conversation through word cloud, ability to move around the room, change viewpoints at will.

Space: The study was conducted in a classroom equipped with large display screens, speech recognition, and motion capture systems. The PSA application instantiates avatars representing people in the conversation and provides the ability to navigate in a simulated environment where the objects in space are placed at the same location as they were in the original conversation. In VR, the room is totally recreated in Unity but in MR only the avatars, tables, chairs, and the display wall are added to the real room.

4 RESULTS

Sensemaking: All users were able to associate voices to respective avatars, complete data specific tasks, find maximum points of interaction in the conversation & identify the areas that users spent most time viewing.

Task Completion Times: The users were assigned 3 training tasks and 6 test tasks. We observed that after the training task, all participants got comfortable with the device usage and interactions with the application. No tasks were skipped. Test task completion times had a mean of 17 minutes (±5.9 s.d.) in MR and a mean of 16 minutes (±3.69 s.d.) in VR. A t-test (two-tailed, two samples with equal variance) showed no significance between the task completion times of the two groups (p-value = 0.59). Figure 3 (a) shows the test task completion times for MR and VR experiences and Figure 3 (b) shows the distribution of test times between Parts 1 and 2.

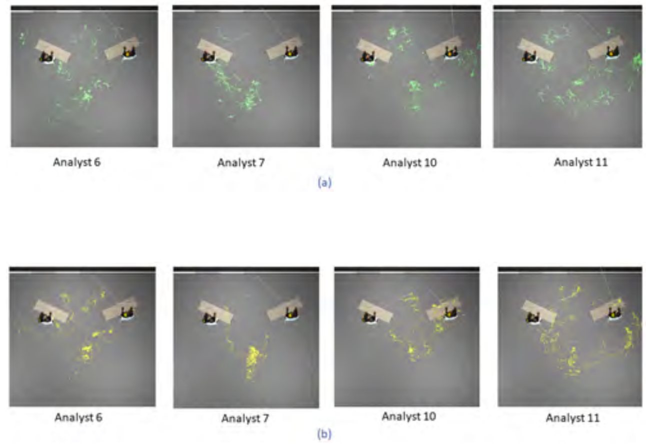

Figure 4: (a) shows the space usage of 4 users 6, 7, 10, 11 in the MR environment for the first 10 minutes(b) shows the space usage of the same users in VR environment for the first 10 minutes.

Space Usage: We analyzed the space usage of individual users in both MR and VR environments for the first 10 minutes and see that irrespective of the environment they show similar patterns of space usage. Figure 4 (a) shows the exploration patterns of Analysts 6,7,10 and 11 in Mixed Reality and Figure 4 (b) shows the exploration patterns of Analysts 6,7,10 and 11 in Virtual Reality. This result shows that the space usage patterns are independent of the device and potentially dependent on sensemaking capabilities afforded by the application for an individual and the choices they make to accomplish a task at hand.

5 DISCUSSION AND FUTURE WORK

The two devices used during the study HoloLens2 and Quest2 used different kinds of input systems. This created an overhead for the analysts to learn two different input systems. It would help to keep the input systems the same across all devices. To achieve this we could either move to a gesture-based system on Quest2 (HoloLens2 already uses a gesture-based input system) or use a voice-enabled input system.

To recreate the environment in Virtual Reality, we utilized a 3D model of a classroom in our laboratory that was previously developed using Blender and Unity. However, it is important to note that this method may not be easily replicable for other settings. Thus, we suggest exploring other options such as using the structure for motion or 360 videos in the VR environment instead, which may be more feasible for certain scenarios.

The ability to change viewpoints in PSA and move around in space offers an effective way of experiencing recorded conversations and can provide valuable insights into how conversations unfold in different contexts. By using situated analytics to visualize and analyze recorded conversations, this research can potentially enhance the efficiency of data analysis pipelines and improve our understanding of complex conversations.

ACKNOWLEDGMENTS

The authors wish to thank Arthur Nishimoto for providing a 3D model of the classroom used in the VR prototype and Juan Trelles Trabucco and Arthur Nishimoto at UIC for providing support while conducting user studies. The dataset used in the user study was collected during a previous user study funded by the National Science Foundation (IIS 2007257).

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