Whispering Wall

Ariel Haney
School of Information
University of California, Berkeley
arielhaney@ischool.berkeley.edu

Prayag Narula
School of Information
University of California, Berkeley
prayag@ischool.berkeley.edu

Rami Taibah
School of Information
University of California, Berkeley
rami@ischool.berkeley.edu

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Abstract
"Whispering Wall" is an interactive art installation, which we envision being implemented in Grand Central Station in New York City. Our interactive installation would enhance the experience of Grand Central's Whispering Wall, where the acoustics of the arches cause a whisper into one corner to be clearly heard at the corner across the hall. Participants who share communications as well as passersby can see their words as they travel up the arches and across the ceiling of the corridor on their way to the listener across the corridor. As words travel across the ceiling they get "caught" in a projection of clouds overhead. As more people communicate using the Whispering Wall the density of the words becomes greater and the color of the words darker. When a certain density of words accumulates on the ceiling, the words start to rain down a section of the wall.

Keywords
Tangible User Interface, voice to text, edge detection, interactive installation, Whispering Wall, Grand Central NYC

Introduction
The Whispering Wall installation allows private communications that are shared in a public space (Grand Central Station) to remain private between communication sharers while also allowing commuters

and visitors in Grand Central to gain insight into the sorts of communications people are sharing with each other. This is accomplished in a three-part process: individual communication visualization, community communication visualization and individual interaction with community communication.

"Post Secret" installation allows people to share private moments in public. In this installation people can view other's actions via a porthole stations located on the street.

The idea of having falling text that spectator's can interact with is also well explored. Artist Camille Utterback's 1999 installation "Text Rain" allowed people to interact with falling text by having the words slide around their silhouettes[3]. In 2007, David Stolersky created installation titled Wallfall in which "@" symbols bounce off people's silhouettes as they interact with falling "@" symbols[4].

Our work builds on both work that explores privacy and anonymity in a public places as well as works that explored interactive falling text. The installation we developed combines both these ideas to create a way for visitors of Grand Central Station to share and interact with the thoughts, comments and possibly secrets, which are typically only shared interpersonal, with a broad public audience in Grand Central.

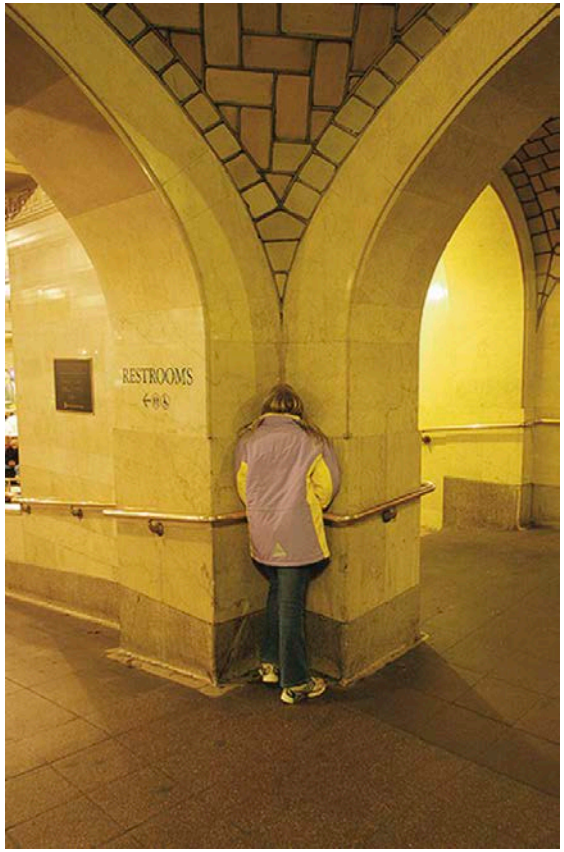

figure 1. NYC Grand Central's Whispering Wall

Related works:

Many works explore the idea of having a public venue for sharing ideas and thoughts that are typically personal or private. The "Post Secret" blog created by Frank Warren allows individuals to share their secrets publicly with the world via the Internet. Jane Edden's

Background

In Grand Central Station the Whispering Wall Corridor is located across from the Oyster Bar. The low marble arches of this corridor allow visitors to stand on either end at a distance of about 20 feet and still communicate. This is achieved by both the speaker and the listener standing facing opposite corners of the corridor. One person starts speaking in either a whisper or a normal tone. The acoustic of the space allow the speaker's voice to be carried up the wall and across the ceiling to their partner standing on the opposite side of the corridor. This partner can hear the speaker as if he were standing next to her even though they are several feet apart, and the corridor is often noisy.

Use case:

Individual communication visualization

When a commuter or visitor first arrives to the Whispering Wall corridor they will see that the space has been augmented. On the ceiling overhead there is a projection of text, which resembles clouds. The idea of a word cloud is quite common and we expect visitors to have an intuitive understanding that the text of words overhead relate to something that has been written or said by other people.

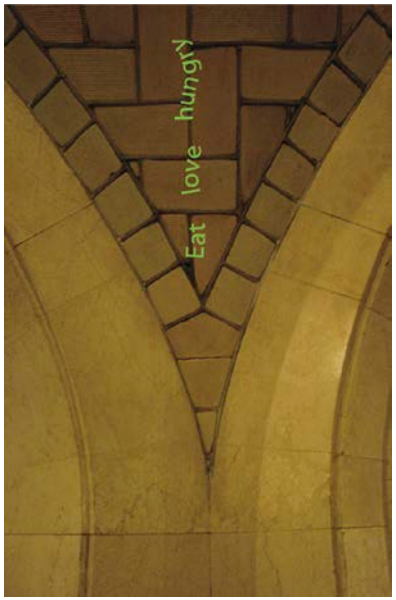

figure 2. Whispered words snaking up the wall

We also expect them to have an understating that this text has a social significance.[5] Unlike more traditional word clouds however, this one will give equal weight to each word spoken and will allow words to appear more than once. By seeing the frequency of the appearance of specific words spectators will have an idea of what kind of content is being shared by the individuals whispering into our art installation.

As soon as someone whisper a message the first interactive portion of our installation will run. As soon a he starts to speak a visualization of words will start to snake up the wall and join the cloud projection on the ceiling.

Community communication visualization
The individual words that people have shared will then start to appear in the word cloud above. As more people communicate at the Whispering Wall the density of the words displayed in the cloud projection becomes greater and the color becomes darker. This should give spectators the feeling that the sky is turning from a bright sunny day to a stormy sky with a threatening storm.

figure 3. Text cloud projection on Grand Central's ceiling

Individual interaction with community
When a critical mass of words accumulates in the cloud, words begin to fall toward the ground like rain. This animation is accompanied by a sound track of a rainstorm. Passersby can interact with this "word rain" by standing in front of a camera, which projects their image on the wall where the rain is falling. When their image is detected, the rain falls around their body. They can cup their hands to hold onto the word-rain or just stand in the word-rain and let the words get caught in their hair and on their shoulders.

System Overview
The system consists of 3 major components:

Audio Processing: using Google's unpublished APIs to provide Speech-to-Text translation. The audio is recorded at a bit rate of 16 KHz in the free lossless audio codec (FLAC). The audio files are then uploaded to Google's servers, processed, then returns the best guesses of the text as a JSON object along with the confidence values. The best confidence values is saved into a text file which is synchronized across multiple machines using a proprietary service called Dropbox.

Cloud Animation: The metaphor of the cloud is explored by projecting and animating these words on the ceiling. The animation depends on the number of words in the files. As the number of the words increases the darkness of the clouds also increases and the animation becomes stormier. This is also accompanied by an audio track, which creates the ambiance of a storm.

Rain and Interaction: As the number of words in the cloud exceeds a certain threshold, the rain animation sequence is triggered. Using a camera aimed at the users interacting with our art installation, the text starts to drop on the video overlay of the users.

Users then can interact with the words falling as raindrops. This is achieved by doing edge-detection on the live video feed from the camera. The edge detection is used to detect the silhouette of the users. The falling words crowd around the silhouette of the users creating an illusion of holding the words and the words 'covering' the user. The edge detection is a simple contrasting algorithm, which relies on the fact that most edges in an image can be detected by finding contrasts in different parts of the images.

Evaluation

People were very excited to interact with the installation during our demonstrations. Often it took them a while to understand that their words were actually being visualized on both the clouds and the rain. This was due to the display set up which was not in Grand Central, but instead in a classroom.

The types of communications people shared varied greatly. Some people share conceptual sentiments such as "Nothing in the Cloud is Secret" others shared movie quotes such as "I see dead people, others wanted to see their name or friends' names represented in the clouds and in the rain. We did not find any users who shared secret or controversial sentences. Many people said random sentences. We hypothesize that this was because they wanted to test the installation to see if it works.

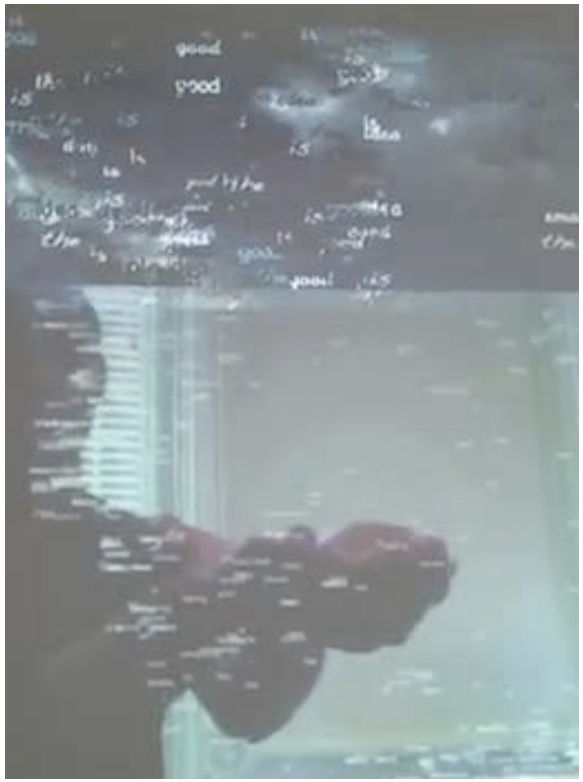

figure 4. Text "rain" interaction by a user

Select examples of text as detected by the Speech Processing engine and our interpretation of what the user said:

- Nothing in the cloud is a secret
- The cat in the hat wears the funny hat
- Come back with a warrant
- Tangible User Interface

The most engaging aspect of the installation was the text rain. It was immediately engaging and was the most assessable aspect of our three-part installation. People seemed less interested in the words that were falling than the fact they could interact with them. In the next iteration of this prototype we could explore displaying the words larger to engage users interest.

Although the text rain was the most engaging aspect of the set up, the installation itself could have been more intuitive. Because of technology and hardware restrictions the area where people interacted with the rain and the area in which their interaction was projected was not located in the same place.

Conclusion

Presenting this installation in the actual Whispering Wall corridor would give us more information about if the installation is in fact successful. The Whispering Wall is in some senses a secret; most commuters and visitors to Grand Central don't know about its existence. Installing an installation here would publicize the space and most likely encourage more sharing than usually occurs.

Acknowledgements

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