Audio AD Write-up

Overview

Our initial hopes were to delve into the domain of film-production, our first pitch being an implementation project. This first idea was an attempt to tackle the problem of boom-mics appearing on the view of the camera. In many film productions, a cause of both embarrassment and refilming is the event of a boom operator (the person in charge of sound on set) mistakenly bringing his sound recording device into frame. Oftentimes, this is a slip in attention on part of the boom operator; however, it could also be a result of the lack of coordination between the camera crew and the person in charge of the boom. For either case, we'd planned to design and create a system that would work to prevent such an occurrence. Specifically, our system was a wearable for the boom operator that sounds a warning whenever the boom is in danger of breaching the camera's field of view.

After a consultation with Dr. Gandy regarding the viability of our project, we were led in a different direction. While the problem of the boom mic appearing in frame is definitely a issue, a system to fix this problem would lack both the urgency and versatility expected as a final project for the course. Additionally, the solution we had in mind (alongside our plans to do implementation rather than design) would lead us to work more on computer vision than audio interfaces. We, as a result, adjusted our plans to make our project more audio-centric while still remaining in line with the domain of film-production.

We then reached out to members of the film-making community on reddit in hopes that we would receive meaningful feedback from experienced film creators. Back and forth conversation between these users was incredibly helpful in steering our project in the right direction. For instance, we learned that in most large-scale productions, since the boom operator's only job is to prevent the mic from entering the screen, the possibility of it happening is minimized. However, in smaller productions wherein the sound department is comprised of one person the warning system is still appreciated. This insight not only tells us the practicality of our idea but also shines light on the fact that there are further distinctions in our user group of film-producers--there are low-budget productions with limited personnel, and others with the resources to cover for small aspects of production.

Another idea that stood out (posted in the reddit thread) was a coordination system. It's known that one of the most gruelling processes on a film-set is setting up the lights. An incredible amount of fine-tuning goes into fixing factors like the luminosity, intensity, and the balance of lighting. Much of the time, a dedicated lighting crew is employed to do the arduous heavy-lifting required to achieve the desired lighting. Since every set is different, the lighting crew is also sent out to make further adjustments to combat unforeseen circumstances. In a standard film-set, the micromanagement of this crew is a responsibility of the gaffer. One could imagine how this could be a difficult job when having to juggle between the various different facets of the lighting--whether it be to add a gel to a lighting fixture, or to adjust the left-right balance of auxiliary lights. Since all the orders are issued by the gaffer, we could see how this becomes a choke-point for efficiency. What's more, the

lighting crew is nearly almost visually engaged -- an attribute that lends well to use of an audio interface. Any task the gaffer wants to issue can easily be transcribed into either an earcon or text to speech message. With an audio interface, we could streamline one of the most time-exhausted processes in film production.

With the complexity of our ideas increasing rapidly, we decided it would be best if we weren't limited by having to actually create the entire system. Designing such a system, instead, seemed like a more feasible idea. This decision alleviated a lot of pressure in minimizing the difficulty in coding the system; we now had the liberty to aim bigger. So, we incorporated a revamped boom-mic warning system to make somewhat of a suite solution to film-production. The boom-mic portion was modified so that there'd be some interaction between the camera-man and the boom operator. In addition to the proximity warning the boom operator received, the camera-man could now notify the operator when he was planning on moving the camera or preparing for a complex shot. This would let the operator prepare for the change and reduce the chance of error. This essentially concludes the timeline on which our ideas were formulated.

Boom Mic Position Warning System

The Boom Mic Positioning System would be a wearable that goes in line with the Boom operator's headphones. Because of the conventions in place with booming and the visually intensive work boom operators have to do (must orient boom toward subject and get as close as possible), this device makes a perfect candidate to utilize an audio interface.

Audio Interface

With an audio interface, we can codify a lot more than the binary of whether or not the camera is close to the camera-field. A metric such as "proximity" can be sonified using changes in either amplitude or pitch. In addition to just the metric of distance, we could be able to spatialize the direction from which the incidence on the camera field is eminent (a possibility we weren't able to fully explore in our Unity demo).

In terms of sound design, we had to look into the environments in which boom operators commonly perform. In productions like talk shows, there could be a preference for a Lavalier mic as opposed to a boom. The utility of a boom mic comes in its ability to pick up sound from a particular direction and, to an extent, drain out the noise coming from an impertinent direction. This quality is very useful in situations where there tends to be relatively large amounts of environmental sounds (that the sound team doesn't want to record), explaining its predominance in non-studio film-sets. Since the variety of film-sets is nearly all-encompassing, it would be preferable to pick sounds that do not clash--with pretty much anything. Our pool of available sounds is now limited to those we wouldn't typically hear out in the open--something similar to the pure sine-waves generated with the BFXR application would be a prime candidate for a feedback sound.

In our consultation with a film producer, who's been active in the field for 3 years, we were told that in his experience, a large number of boom operators were also in charge of mixing the sound. As a result, having an invasive sound feedback on the boom system would actually be a detriment to the production rather than a utility. He'd additionally suggested for the audio interface, that we should vary intensities by speed rather than amplitude, an insight that stems from the idea that panicking the boom operator is not beneficial.

One particular redesign that this led to is the concept of using this as a heartbeat, rather than an "alarm" system. An analogy would be usage of a car's sonar system. When parking, people use the frequency of the beeps as indication of how much farther they can go; the sound feedback is not necessarily a negative reinforcement. It's more of a "meter" of proximity that the user can check as an indication of status. The change is reflected in our simple processing sketch, which was our first attempt of designing from the perspective that the system is more of a dashboard than a notification. Granted, the sketch still used our older, more invasive sound loop for the alarm; however, this exercise forced us to look at other factors and variations, namely the function we use to increase the "intensity" of the alarm. As mentioned, one of our earlier ideas was that a change in the proximity could be codified with a change in intensity in the sound. This is to mean that we can vary attributes such as playback amplitude and rate to signify the proximity. We explored the idea of having a quadratic curve relation for our amplitude, wherein the sound increases according to quadratic curve--inspired by the notion that the sound matters significantly more when it's closer than when it's not.
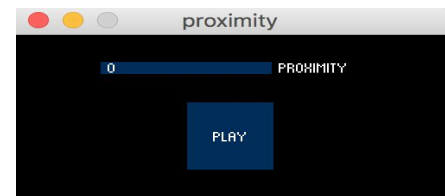
Additionally, we explored an expansion for our system--one with interaction between the cameraman and the boom operator. The feature would be primarily for complex shots that involve movement of the camera. We envisioned a "handshake" that involved the cameraman opting to send an audio cue to the boom operator that will indicate that a change is about to take place. Typically, these shots are pre-planned so that everyone involved is on board, and this would serve as an additional precaution. The sound choice comes with the assumption that the operator is currently using the proximity system so as to not clash with the other tones.

With all these considerations, we designated our proximity indicator sound to be a short loopable beep sound we chose from freesound, included in our submission as "tone-beep.wav".

Unity Demo

With our Boom Positioning System Unity demo, we wanted to showcase how the process of booming would be with and without our interface. This demonstration is a simplified version of a film-set meant to emulate a boom operator performing his task. It also doubles as a participatory design activity since with the simulation, we can effectively gamify the boom operator's task. The goal of this demonstration would be to keep the boom as close to the subject as possible (the car) while keeping out of the zone. The demo runs for

30 seconds and the scoring system is essentially have a multiplier based on the distance away from the subject (more points are awarded for more proximity). This scoring system is a method to measure the system's effectivity.

After a number of user trials, we found that users playing with the aid of the audio assistance generally performed better across trials. When questioned about how intuitively they understood the assistive sounds, most replied that it was relatively easy to figure out.

Lighting and Rigging Coordination System

The Lighting Coordination System is our attempt at streamlining one of the most arduous processes in film: setting up the lights. There are essentially two types of users in this system: gaffers or directors of photography and lighting crew. The gaffer's role on set is to direct the light crew to the DP's (director of photography's) approval. The reason the whole ordeal is so slow could be attributed to the bottlenecking at the commands the gaffers gives. The lighting crew must defer to the gaffer's orders, and typically refer back to gaffer if they incur any problems. Access to the gaffer is scarce, thus leading to this immense slowdown. This system is, in essence a network of wearable devices that garner audio interfaces to facilitate the process of communication between the lighting crew. For this situation, the audio interface is a good fit because of the nature of the lighting crew's work. They are tasked with moving heavy objects or assembling specialized parts. Much of the time, they are visually engaged, rendering it a perfect scenario to utilize audio interfaces. As for the wearable itself, the device will (similarly to the boom mic positioning system) go in line with the headphones that the lighting crew will have.

Audio Interface

Much of the specifications we went over in the section for the Boom Mic Positioning System's audio interface will easily carry over to this interface (with regard to environment) but we get a bit more leeway with how much information we can bombard a lighting crew member with. The following is an overview of the
Audio Choices:
- TTS: The gaffer decides tasks and the task is delegated a currently free member of the lighting crew. This allows the gaffer to easily delegate tasks to specific people without interrupting any of the others.
- A Short Earcon: Whenever a member of the lighting crew finishes his or her tasks. The gaffer is notified via a short earcon. This would meld well with the environment. This was chosen to be quick and sharp so the gaffer is both notified of the completion and be interrupted for a minimum amount of time.
- A Longer Earcon: This earcon is played when the entire lighting crew is finished with their tasks. This notifies the entire crew that setup is completed and filming can begin.

Unity Demo

Our Unity demo follows a film-set with the user playing the role of DP ("director of photography"). In this demo, we are able to experience the audio interface setup for the Lighting Coordination system. Through the demo, we follow the capsules labelled as lighting crew performing various tasks. For the sake of understanding, we set it up so that each "worker" will receive his task in order.

App Interface Demo

In designing this application, I had to keep in mind that scenes change during a set, and this is when our software is most useful. Usually, scenes are set in advance and all the crew will know what they are doing on the day of the shoot. But, with such a large production, there is bound to be some change and variability and that is when our software and audio interface will be most useful. Gaffers using our system can easily drag and drop objects onto their scene and build it to how they want it to look. A list of tasks will then be produced by our system based on the scene built and the number of crew members available. Because there are other miscellaneous tasks our system may not account for, we have a custom task creator. A gaffer can also go and edit the requirements of a task before it is pushed out just by clicking on a task. When the gaffer is happy with the tasks produced, he/she can click broadcast tasks and tasks will be distributed to crew members that are free. Crew members will get an auditory notification that they have a task to do at that point, so the gaffer does not need to go and tell each crew member what their new task is. Also, the requirements set based on the task will be read out loud to the crew member one at a time as they complete each requirement. A gaffer at any point can go and edit the requirements of a task, and the crew member will be notified of the update. Supposed a gaffer wants to talk to a crew member in charge of a specific task, he/she can also choose to talk directly to them with our system rather than having to go find them or talking into a system where everyone else can hear a conversation that does not pertain to them.

Contributions

- ❏ Yash Tulsiani
    - ❏ UI Mockup for Gaffer
    - ❏ Sound Design
    - ❏ Conducting User Test Trials
- ❏ Varun Ramachandran
    - ❏ Unity for Boom Scene
    - ❏ Write-up
    - ❏ Sound Design
- ❏ Xuran Chen
    - ❏ Editing Video

- ❏ Unity for Lighting Scene
- ❏ Sound Design
- ❏ Rishi Raj
  - ❏ Expert Contact
  - ❏ Unity, both
  - ❏ Sound Design
  - ❏ Conducting User Test Trials

How To:

- Exe file has our Unity demos (you can pick a demo from the home screen). You can run these with any **Windows** device
- App mockup can be opened as an HTML document in browser (http://refdy2.axshare.com/#g=1&p=set_scene)
- Youtube demo shows the user testing for our Unity app (https://drive.google.com/file/d/0ByxsQMAZdpxwckNVZkpZRnVkem8/view)