CS 147
Assistive Technology and Accessibility
Assignment #2 - POVs, HMVs and Prototypes

Audio Reality

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Problem Domain

Everyone knows someone with hearing loss, but those who are hard of hearing – especially young people – face discrimination and exclusion, on top of difficulties with daily tasks. Hearing impairments are often invisible and misunderstood, despite affecting 5% of the population. We focused on hearing impairments at school, which came out of our studio category, Assistive Technologies and Accessibility.

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Initial Point-of-View

J, a 21-year-old college student who is fiercely independent and wants to travel

In our first round of interviews, we met J, a college student who has congenital bilateral medium deafness. At 17 days old, doctors fitted J with hearing aids that allowed him to hear at more or less normal levels. He told us that he must wait several days and travel over an hour during the week to be seen by an audiologist. This long wait is due to the lack of audiologists licensed to handle J's hearing aids.

He is an independent person who likes to travel but feels limited by his hearing aids. He is going abroad in the spring to a country that only has one audiologist who can work with his hearing aids. If they break, he could be without hearing for a week or more. It would be game-changing if J's hearing aid issues did not disrupt his life.

Additional Needfinding

Following the first-round interviews, we were unable to find one major challenge or experience shared between our interviewees. However, small troubles did arise more than once. For example, hard of hearing people can feel uncomfortable asking people to repeat themselves. We understood that our target group needs accessible ways to capture a conversation. Thus, we expanded our interview topic to include school, travel, and tech and gained many more insights.

Interview #1: MO

We talked to MO, a deaf substitute teacher and community organizer. She expressed incredible frustration throughout our interview, sharing with us stories of being ignored, dismissed, or even hung up on due to her deafness. Many of these incidents she blames on hearing people “having no patience” for ASL relays, texting, or the other methods deaf people use to communicate to hearing ones. She wanted speedy, simple communication. ASL interpretation was her favorite method of communication, followed by ASL relays and texting.

She was particularly concerned about the lack of ASL interpretation in hospitals. The last time she had an MRI, she brought her mother in rather than go through the hassle of getting an interpreter.

Interview #2: TP

We spoke with TP, a student and deaf community organizer at Stanford. He talked about how much better Stanford was than his high school. Like MO, he told us how people in his high school became frustrated when he asked them to repeat a question. He uses hearing aids, but loses comprehension when he’s in a chaotic environment or a classroom with multiple voice sources (like a language seminar).

He approved of Stanford's accommodation options but advocated for for more automatic accessibility. He told us he felt uncomfortable asking professors to wear a microphone that connects to his hearing aid because of time pressure.

Interview #3: SM

An elderly but social Menlo Park resident, SM met us and offered insights on her hearing implants. She seemed content with her devices, though they picked up excess noises that bothered her. Eventually, however, she stopped hearing these noises. She suggests the human brain adjusts to block out this disturbance.

She has heard many complaints about hearing aids, particularly from her husband. He had used them and threw them in the trash. Her devices can get messy to clean due to wax buildup, which makes her appreciate her audiologists more. Each hearing impaired person she knows uses unique methods to circumvent their impairment, such as sitting near walls in restaurants.

POVs and HMWs

POV #1: MO

We met MO, an activist and deaf substitute teacher, who is very frustrated with how hearing people treat deaf people. We were amazed to realize that people would hang up on her if she was not talking fast enough or if they realized that she was deaf. It would be game-changing to enable deaf people to communicate at the same speed as hearing people.

How might we…

- get hearing people to use sign language and learn it fluently?
- slow down conversations?
- make conversation a stroll instead of a sprint?

POV #2: MO

We met MO, a deaf teacher and community leader who relies on her phone to communicate with most hearing people.We were amazed to realize how often interpretation wasn't present when it was needed most–in emergency medical situations. It would be game-changing to make sure MO could always communicate via her preferred method (ASL).

How might we…

- **HMW make emergency services accessible for deaf people**
- HMW allow doctors to diagnose their patients without needing to talk to them
- **HMW help deaf folks who have trouble speaking be understood by the general public**

POV #3: TP

We met TP, a deaf activist on campus who dislikes special attention. We were surprised to realize he didn't feel comfortable asking professors to wear a bluetooth microphone during lecture. It would be game-changing to allow him to understand lecture perfectly without the professor ever being aware of his hearing impairment.

How might we...

- **make lecture like reading a book**
- make captioning/providing lecture in a non-auditory format the norm
- make going to lectures unnecessary in education

Solutions & Prototypes

Solution #1: Assisted Reality Glasses + Live Transcribe = Better Lectures

We met with a deaf activist, TP, who said he didn't feel comfortable asking his professors to wear a microphone just for him. Providing him with a method to understand lectures without the professor's special attention would be game-changing for him.

Certain theaters provide AR glasses that put captions in your line of sight. We thought that a similar system could work for lectures at Stanford. Google live transcribe could capture the professor's voice, while AR glasses would display the captions to the user.

We assumed that students could follow lectures with captions in their field of vision. To test this assumption, we created a paper prototype and a simulated lecture. One student gave a short math lecture. She alternated between facing the tester and facing the board so that the tester could only read lips part of the time. Another student had a set of paper strips with the lecture script written on them. He held them up before the student in real-time during the lecture.

The tester paid attention to both the lecturer and the captions. We had trouble positioning the paper such that it was in the tester's field of vision, but not blocking the whiteboard.

The tester confirmed our assumption that people could follow a lecture while reading captions in their field of vision. He said that he was used to looking between captions and the lecturer because he had captions[1] on a tablet during class.

We learned that manual captioning is slower than speaking, so he often ends up 10-20 seconds behind the lecture. When we asked about auto-captioning, he enthusiastically showed us Google Live Transcribe on his phone. One new assumption is that Google Live Transcribe is fast and accurate enough to be preferable to manual captioners. We also assume that people can learn how to switch fluidly between the lecture and the captions, as our tester did.

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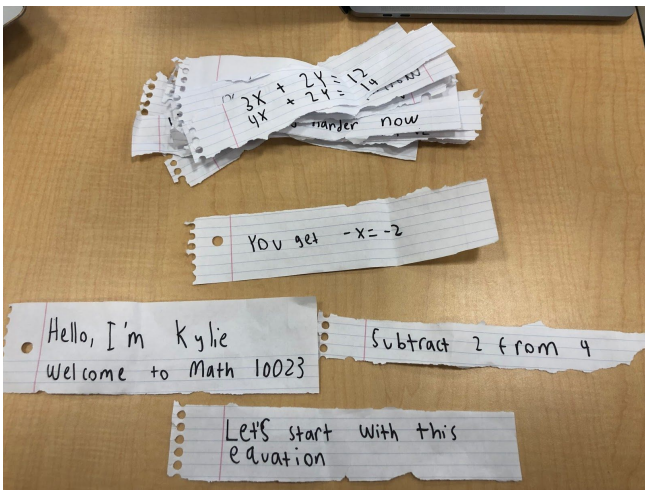
[1] Recorded manually by an off site transcriber. Stanford students also have the option to have a stenographer in the classroom with them, but this was described as limiting.



Paper captions were the key artifact for our prototype.

Our participant looking at captions and the lecturer.

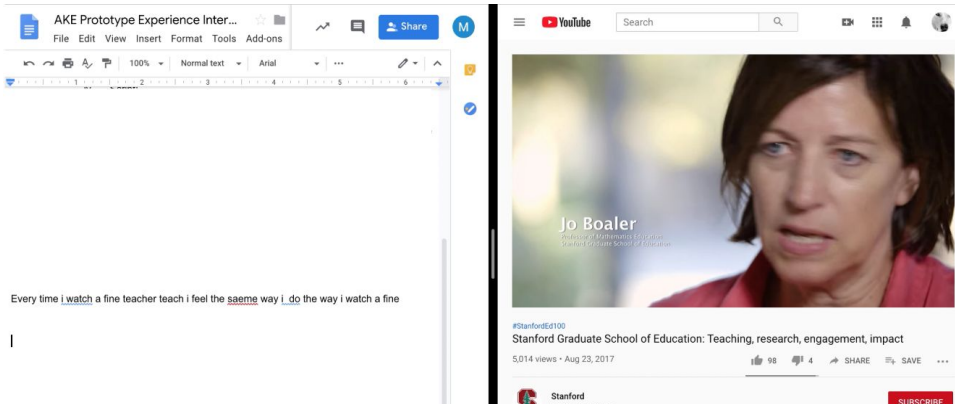
Solution #2: Collaborative real-time transcription of lectures by volunteer students.

For those with hearing impairments, captioning is made available during lectures. However, one interviewee said captioners are 10-20 seconds behind the lecture.. As he put it, he “has to choose between focusing on what the teacher is saying now or catching up with the captions.” Thus, we decided to implement a solution to lecture captioning that would allow real-time transcription.

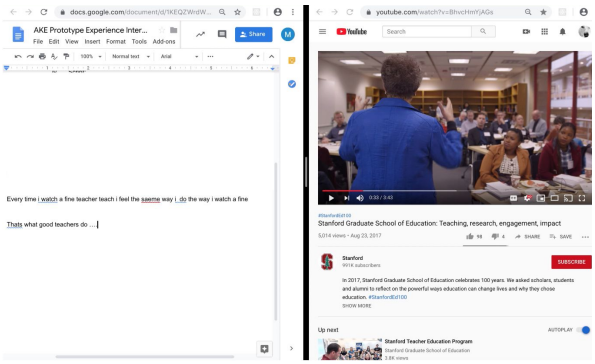
For faster live-captioning that didn't exhaust the captioners or require Stanford to hire more of them, we imagined having students transcribe the lecture for a few seconds at a time, once every couple of minutes. This crowd-sourced lecture would come out in real-time, without the difficulty or expense of more captioners.

Using existing software, we were able to simulate a demo of our solution for the prototype. In order to see how this would work in a classroom, our group met with a disability advisor from the Office of Accessible Education (OAE) in their office.. Our prototype consisted of a mock rehearsal of how we would incorporate student typers. This experience interview tested the assumption that untrained students could watch and transcribe lectures simultaneously. The student used Google Docs to record and share the transcriptions.

One of the team members transcribed a pre-recorded lecture in bursts, and produced workable captions, according to the OAE member. However, the transcription contained many errors, so our assumption was neither proved nor disproved. An untrained student can watch and type, but not well. Our new assumption is that students can type fast enough to transcribe lectures, but they need the practice to do so without making mistakes. Also, we need to test whether or not students can coordinate their actions well enough to transcribe the entire lecture.



Using a Google Docs and Youtube side by side, we demonstrated to the OAE member how a student could watch and transcribe a lecture simultaneously.

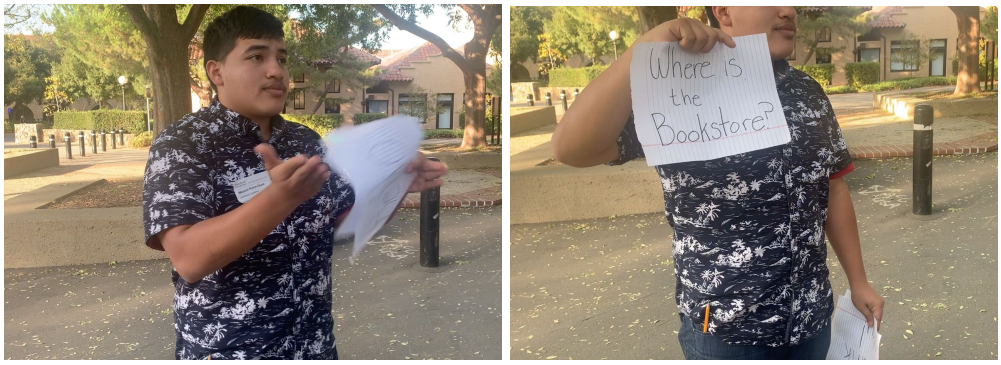


A pause was taken in between typing sessions to allow for "student typers" to rest.

Solution #3: American Sign Language (ASL) detection to provide instant communication

The third experience prototype tested the ability to make American Sign Language accessible. We assumed normal hearing people often found communication with deaf people difficult because they were not fluent in ASL.

To create the prototype we utilized the camera functionality in our phones to capture an AR-member speaking in ASL. The speaker would then hold up written translations of the ASL phrases in order to communicate to the camera holder what was said. In order to gauge the interest in a feature like this as well as immediate challenges, we took to the field (White Plaza) to survey.



Manuel is using ASL (left) to say the "book" in the translated phrase that is held up (right)

Fortunately, we met OO, a Palo Alto resident who is from Germany. While O does not have any hearing impairments, she has some insights on the challenges one faces when trying to communicate with people with hearing loss. During our demonstration, O expressed confusion

with how ASL was structured. Despite this, O confirmed our assumptions by commenting that she believed this was useful technology. A defining opinion she offered was that deaf people would have to be prepared to have this solution ready to use for regular hearing folk.

We learned despite our efforts normal hearing folk will face hardship in understanding ASL however, they will still believe our solution to be effective. What we found ineffective in our prototype is we assumed normal hearing people would be aware of ASL enough to utilize our solution. This testing yielded a new assumption: hearing impaired people will have to take the initiative in the implementation of this solution.

Moving Forward

Following our prototyping sessions, we determined that #1 (AR glasses with captions) would be the best solution. Pursuing this possibility addresses many of the nuisances encountered by people with hearing impairments in school, especially the speed of communication. While Solution #3 (Auto-ASL translation) was intriguing, it did not eliminate communication issues with non-ASL speakers. Solution #2 (student transcriptions) was error prone, and not faster than early experiments with Google Live Transcribe. Additionally, the AR glasses solution is circumspect, and wouldn't require a deaf person to explain ASL to a hearing person (#3) or draft scores of students (#2).