Get Your Head in the Game:
Custom Assistive Headset

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Problem Statement

- The client would like the work at the front desk and needs a device to help him hold a phone, so he can write and talk on the phone simultaneously
- The client has the use of one hand and cannot hold the phone between his head and shoulder
- The device will need to accomodate for a larger head and smaller ears, which many current options do not accommodate for

Background

- There are devices that can hold existing phones for users.
    - The suction cup can hold a cell phone, which is smaller than the client's desk phone.
    - The neck lanyard can hold a phone for the client to use on speaker phone or with earbuds.
- Neither is ideal since the workplace is too loud for speakerphone, and the client cannot put anything in his ears.

Background

- Other devices can plug into existing phones or connect by bluetooth.
    - They feature headphones for the user to place in or over his/her ear canals, typically connected by a hard headband
    - These devices are not ideal since the client cannot place anything into his ears, and the bands are typically too small to accomodate for his head size.

Prototypes: Velcro Hat

- The velcro hat features a visor with a piece of velcro attached to the inside.
- Uses the external phone to avoid using bluetooth or wiring a device to use the headphone jack
- Another piece of velcro is attached to the phone to easily attach the phone to the hat.
- Difficult to put on with one hand
- May add pressure to the head due to the phone's placement.

Prototypes: Headband Pocket

- Fabric band with an elastic sewn inside, and a pocket for the existing phone
- Uses the external phone to avoid using bluetooth or wiring a device to use the headphone jack
- Snaps on the phone pocket allow it to be easily attached and removed from the headband.
- However, the phone weighs down one side of the headband, which can cause discomfort

Current Prototype: Adaptive Headphones

- Modified over-the-ear headphones with telemarketer headset speaker and microphone
- Longer aluminum band, longer microphone which works in far proximity to user
- 3D printed microphone adapter
- Wires for microphone and speaker were soldered onto circuit board
- Able to be put on and taken off with one hand
- 3.5 mm headphone jack
- Covered in foam and Star Wars fabric

Design Study: Styrofoam Head

- Tested whether the headband pocket would leave any pressure marks and how long it could stay on the head
- There were no marks left behind and minimal slippage in the 3 hours tested
- The pocket appeared to rest on the ears and weighed the head down on one side
- The head did not match the client's head-shape
- Revealed that this design was not ideal for the client

Design Study: Type of Metal Band

- The purpose of this design study was to determine what type of metal to make the headband portion out of: aluminum, iron, or copper
- Bent the metals to conform to the head-shapes, then maximum separation between the metal and the head after 24 hours
- Copper was least effective in keeping its shape, iron and aluminum were equally effective, but aluminum was more accessible in the correct lengths
- The study did not use the same heads for each metal or test other characteristics of the metals such as fatigue and elasticity

Design Study: Speaker Microphone Test

- Tested the quality and volume of various speakers and microphones to determine which would be used in the final prototype
- The first version of this study compared Pansonic headset to the ProHT multimedia headphones microphone and speaker
- The Panasonic speaker and microphone produced better results when used with Audacity but its microphone was too short
- Tested the Arama cell headset and found it did better than panasonic
- Provided qualitative and quantitative data for success but no way to keep the voice of the person testing at a constant volume

Table 1: Speakers and their functionality

Type of Speaker	Loudness (0-5)	Sound Quality (0-5)
ProHT Multimedia Headphones Speaker	1	2
Panasonic Comfort Fit Speaker	4	4
Arama Cell Phone Headset	5	5

Table 2: Microphones and their functionality

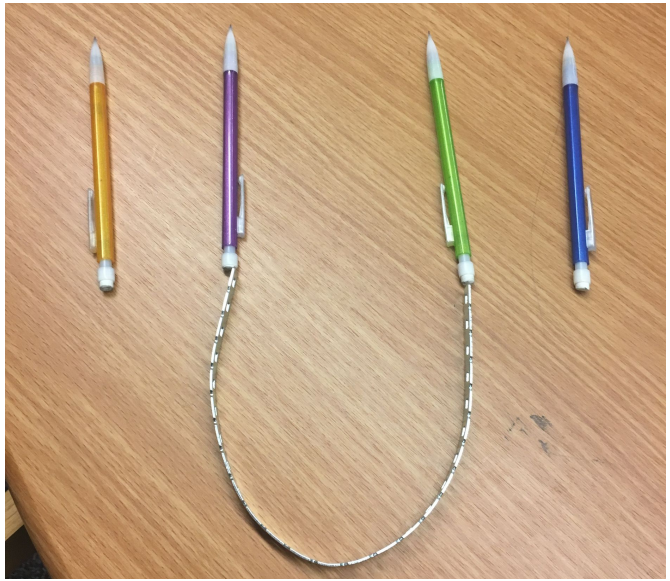
Piece of Hardware	Amplitude of Sound Recording (0-5)	Quality of recording on playback (0-5)
ProHT Multimedia Headphones Microphone	1	0
Panasonic Comfort Fit Microphone	3	3
Arama Cell Phone Headset	5	5

Design Study: Fatigue Tests

- Tested the quality of the metal band to be used on the top of the headset
- One test was completed by fastening a full water bottle to one end of the metal and holding it horizontally on a table with the water bottle end hanging off the edge
- The water bottle was dropped and the metal was bent downwards.
- The metal was flipped over so that the bent end was sticking up and the water bottle was dropped again, bending the metal in the opposite direction.
- This was repeated 25 times and the metal was still very rigid and had not bent.

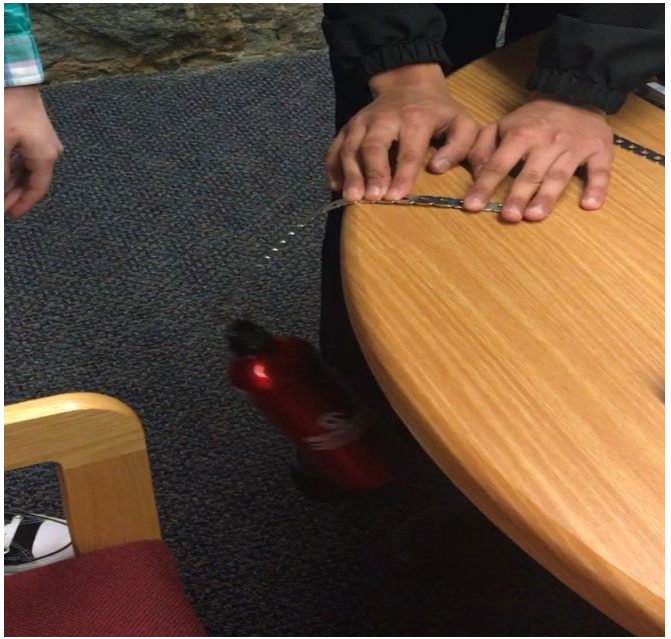
Design Study: Fatigue Tests Continued

- A second test was completed by counting the number of times the metal could be bent completely in half with both ends touching.
- The metal could be bent completely in half 16 times before snapping.
- A third test was completed by counting the number of times the metal could be stretched from a rounded position and repositioned again.
- The metal was stretched from position 1 to position 2 and back to position 1 50 times and the metal was still rigid.
- All three fatigue tests revealed that the metal strip chosen for the headband portion would be strong enough to support daily bending.



Third fatigue test: The metal was bent in a U shape

Third fatigue test: The metal was stretched to a wider U shape



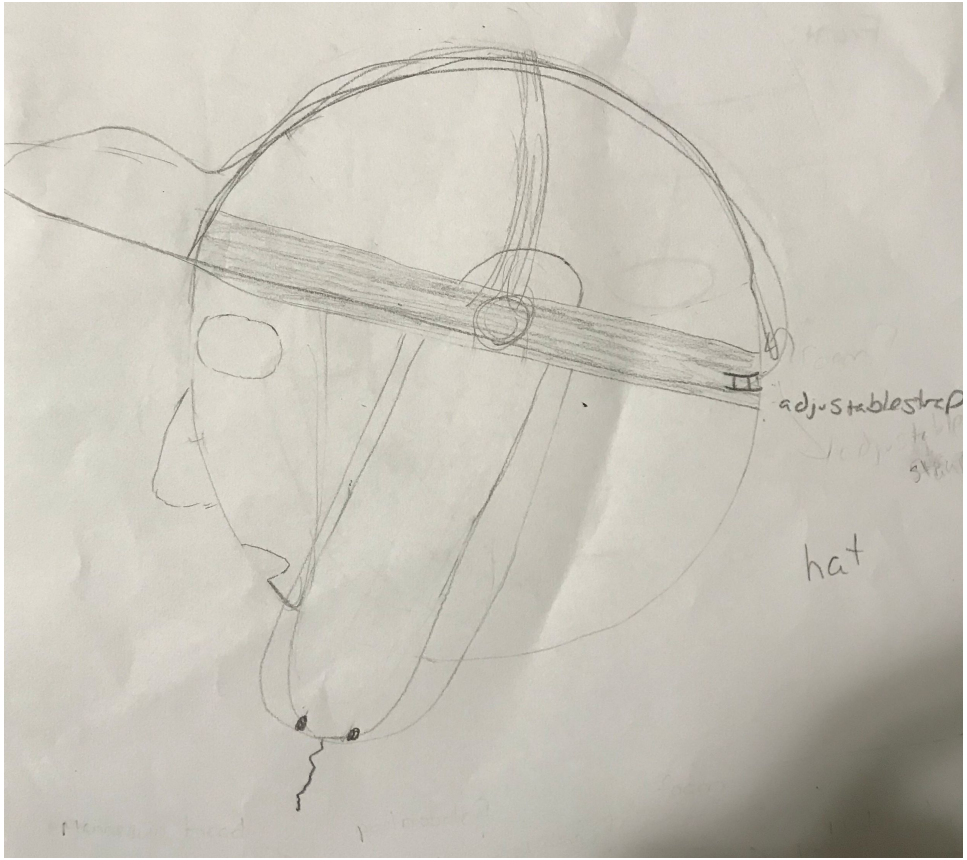
First fatigue test: Metal was held off the edge of a table

First fatigue test: Water bottle was dropped and the metal bent

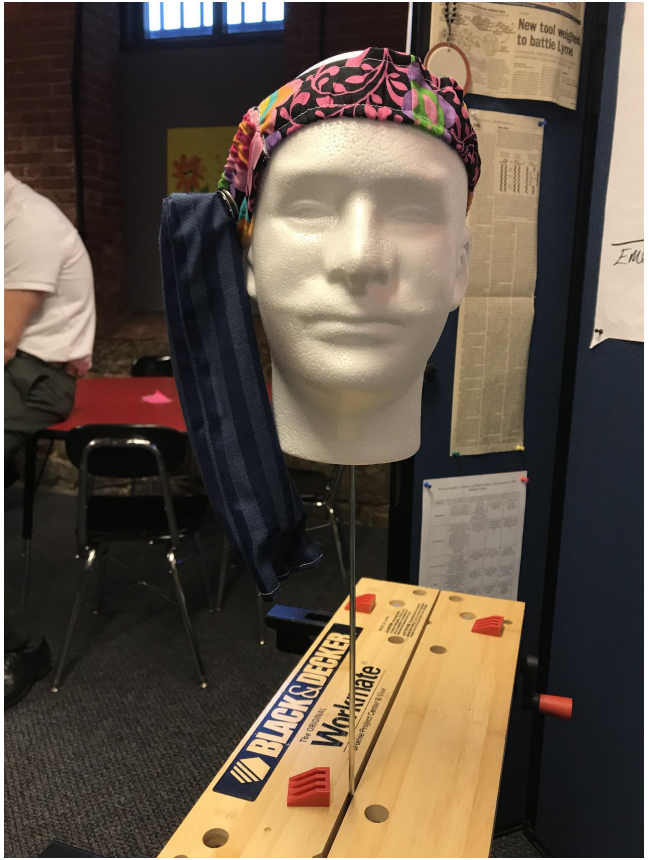
Parts of the over-the-ear headphones separated

Headset with modified longer aluminum band and foam

Fatigue test, bending the metal with a water bottle for consistency



An original prototype drawing of the headband pocket as a hat



Design study for styrofoam head

The iron piece on the plastic mannequin head after testing

The copper piece on the styrofoam head after testing

The aluminum piece on the papier mache head after testing