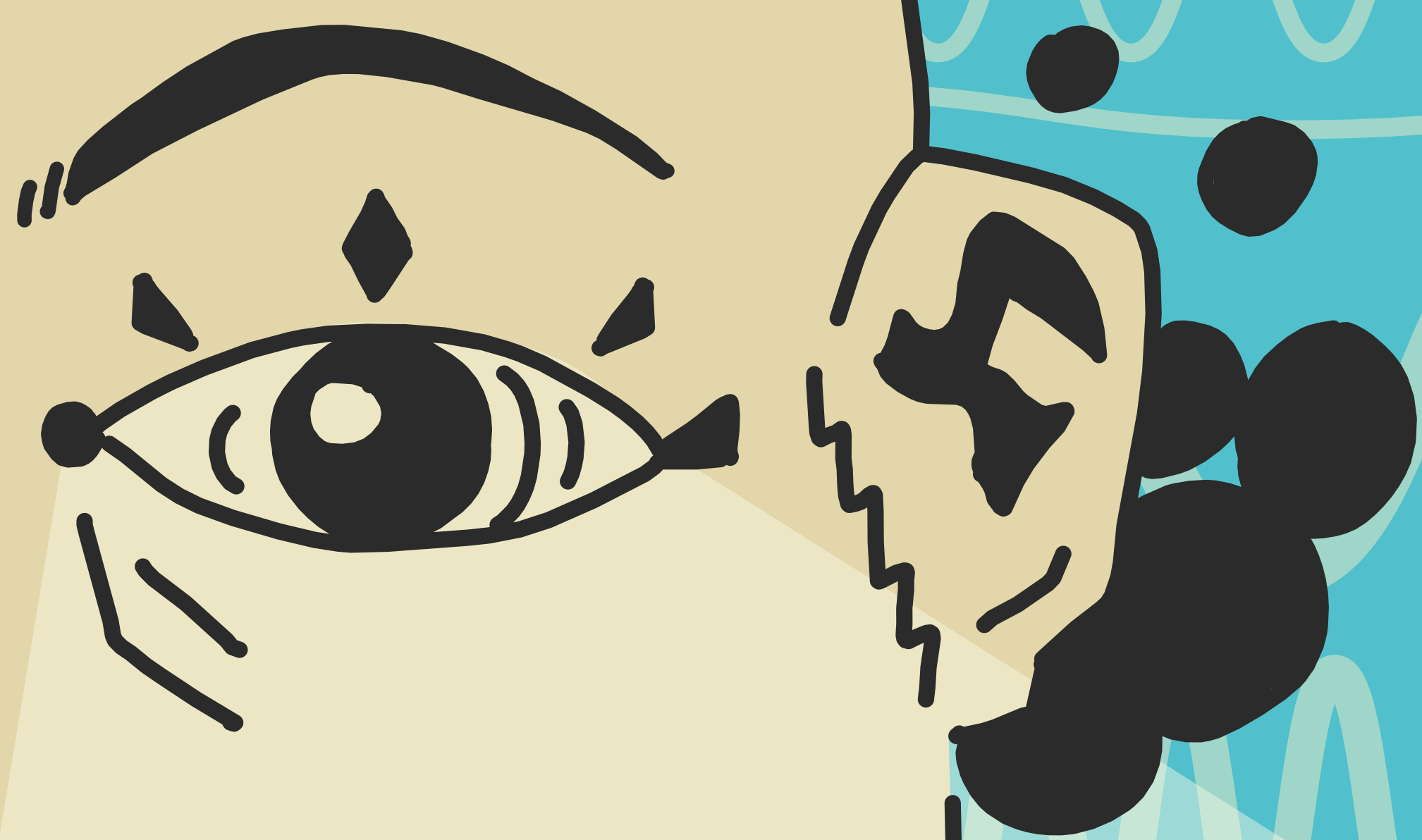




### Santa Maria Tzejá

From the rural rainforest in Guatemala, Santa Maria Tzejá has survived a brutal 36-year-long civil war. Despite economic struggle, Santa Maria Tzejá endures via community-based cooperative government



**4.3%**  
Newborns screened for hearing loss in Guatemala

**\$5-10k**  
Average cost of an OAE screening device

**8k**  
Number of MA children mandated to be screened by OAE



### Massachusetts Head Start Program

Lisa Myette is the Health Service Director at the Cape Cod YMCA Early Head Start program. The US Head Start program mandates but does not provide funding for OAE hearing screening tests for all enrolled students.

Lisa Myette



### Needham Guatemala Partners

Our community partners provide invaluable insight on stakeholder perspective and need. Needham Guatemala Partners is tied closely to community in Santa Maria Tzejá.

Dra. Castellanos



# BACKGROUND



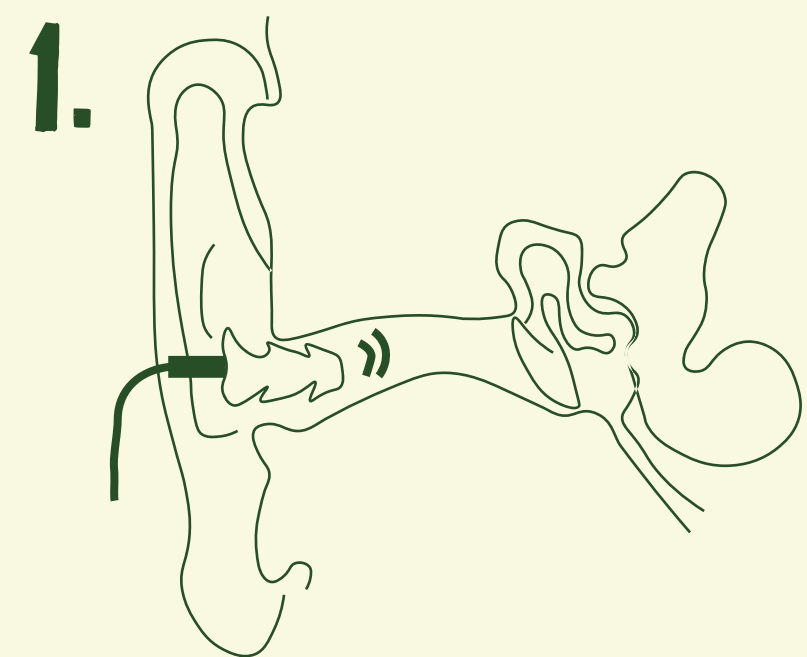
# OUR MISSION

## THEORY OF CHANGE

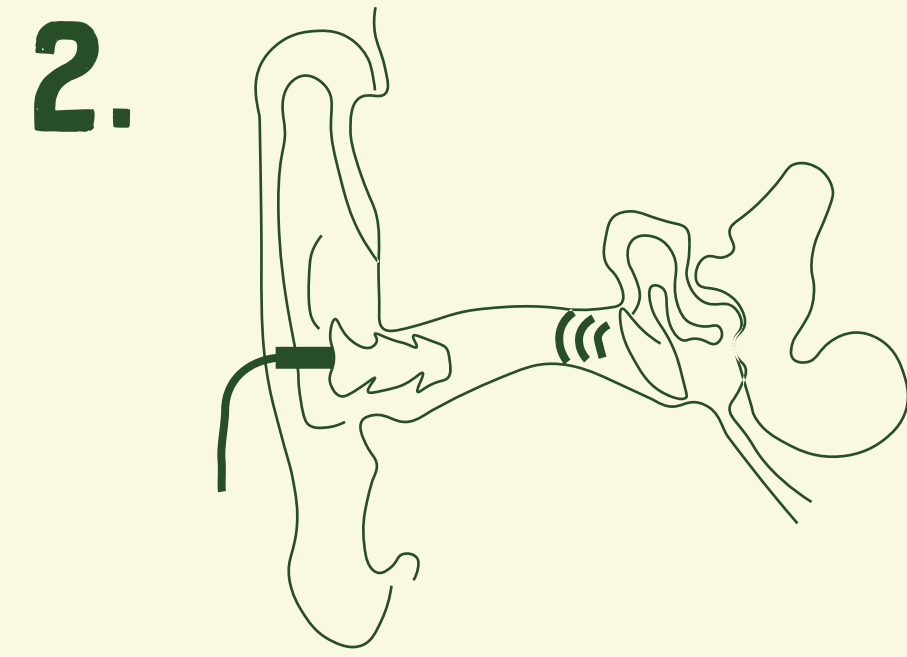
WE ARE DEVELOPING AN ACCESSIBLE HEARING SCREENING DEVICE USABLE BY AUDIOLOGISTS AND TRAINED COMMUNITY MEMBERS TO PROVIDE ACCESS TO EARLY CHILDHOOD HEARING HEALTH INFORMATION. THROUGH USING THE DEVICE, COMMUNITY-BASED HEARING HEALTH SYSTEMS ENABLE DISPROPORTIONATELY BURDENED POPULATIONS TO MAKE INFORMED MEDICAL DECISIONS AND IMPROVE LIFE OUTCOMES.

## WHAT IS AN OAE DEVICE?

AN OAE DEVICE IS A HEARING SCREENING DEVICE THAT DOES NOT REQUIRE PATIENT FEEDBACK, MAKING IT PARTICULARLY USEFUL FOR TESTING NEWBORNS



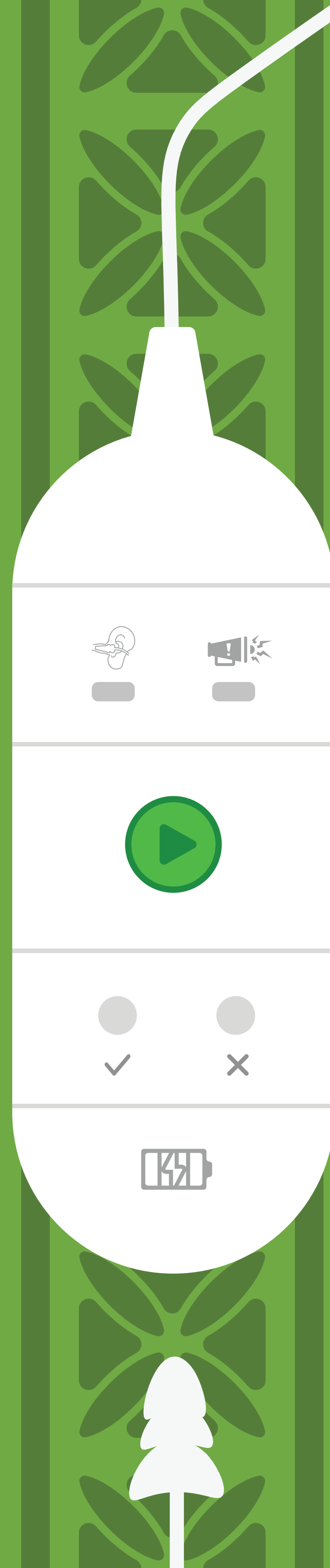
THE DEVICE PLAYS TWO FREQUENCIES INTO THE EARS USING SPEAKERS.



HEALTHY EARS WILL PRODUCE A THIRD FREQUENCY THAT WE CAN PICK UP, WHEREAS EARS WITH SIGNIFICANT HEARING LOSS WILL NOT PRODUCE THIS THIRD FREQUENCY.

## TARGETED SECONDARY SCREENINGS

BY USING OAE DEVICES TO SEND INDIVIDUALS SCREENED WITH A REFERRAL RESULT TO EXPERTS, MORE TARGETED AND WIDESPREAD HEALTHCARE CAN BE ADMINISTERED. WE HOPE THAT THIS INCREASES SPECIALIZED HEARING HEALTHCARE BY PROFESSIONALS.



## WHY US?

14/16

THE NUMBER OF INTERVIEWEES WHO SUCCESSFULLY USED OUR DEVICE THEIR FIRST TRY



25%

THE MINIMUM AMOUNT WE ARE DECREASING OUR PRICEPOINT FROM THE CURRENT SALE VALUE OF OAE DEVICES, WHICH RANGE FROM \$5-10K EACH.



## COLLABORATORS AND SPONSORS



SPECIAL THANKS TO SOLAR EAR, WHO WILL BE BRINGING OUR PRODUCT TO MARKET AFTER THE DEVELOPMENT STAGE, AND TO THE ORGANIZATIONS WHICH MAKE THIS WORK POSSIBLE THROUGH FUNDING AND SUPPORT.





# USER EXPERIENCE

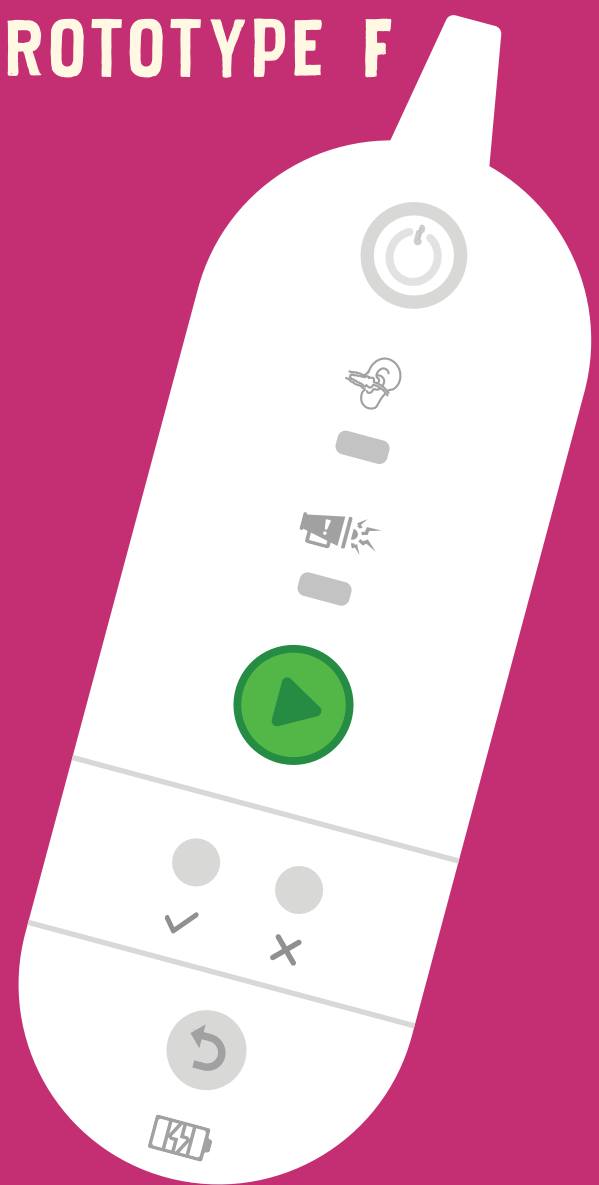
## PROTOTYPES

WE ITERATED UPON PREVIOUS DESIGNS AND TESTED THESE IN USER INTERVIEWS. PROTOTYPE H IS OUR NEXT ITERATION TO BE TESTED!

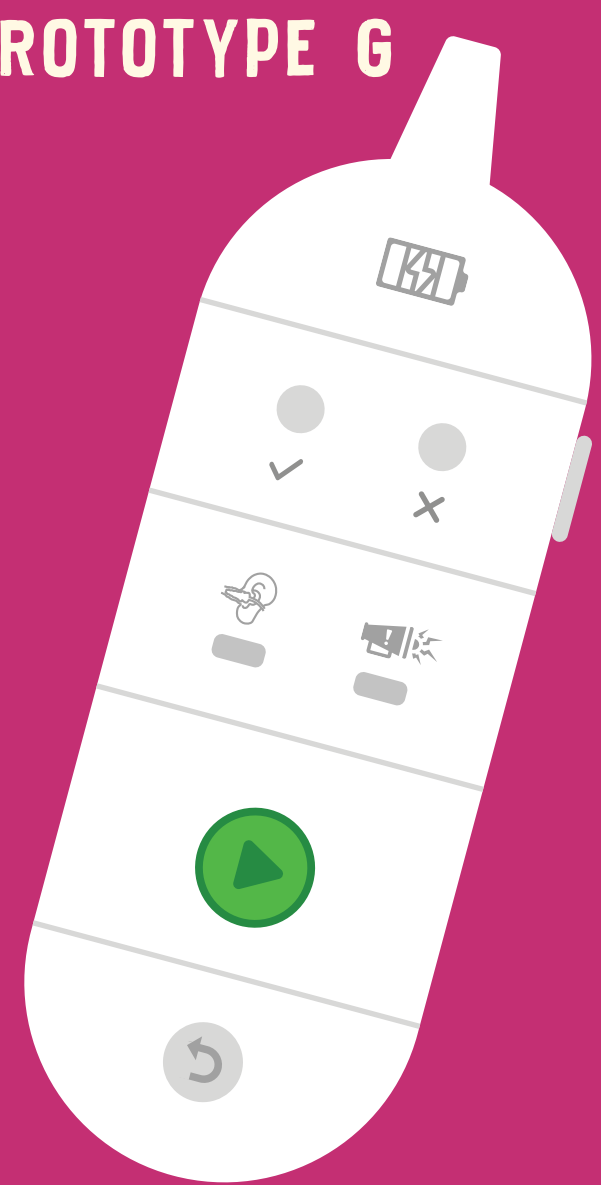
PROTOTYPE E



PROTOTYPE F

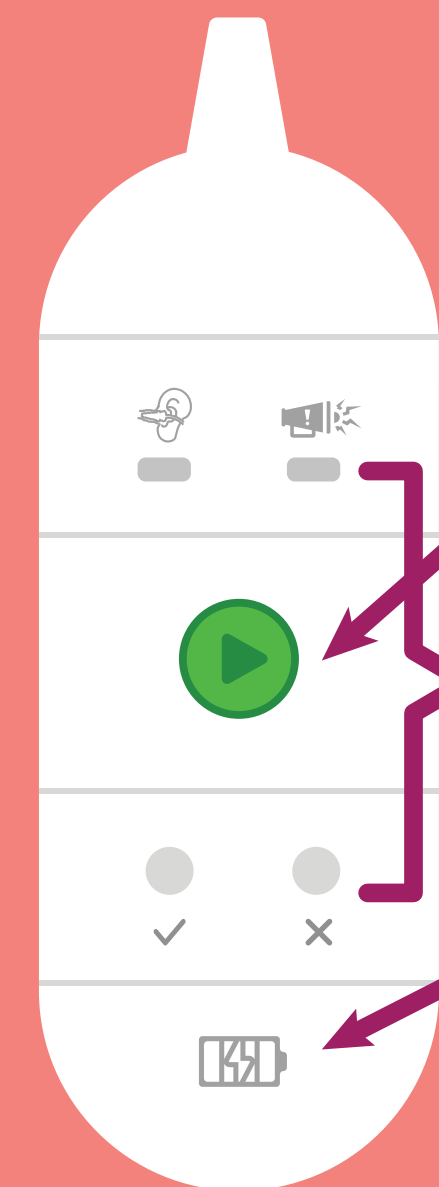


PROTOTYPE G



## NEXT ITERATION

PROTOTYPE H



REMOVED RESET BUTTON

SIDE MOUNTED POWER SWITCH

CENTRALIZED RUN BUTTON

DELINEATED RESULTS AND CONDITIONALS

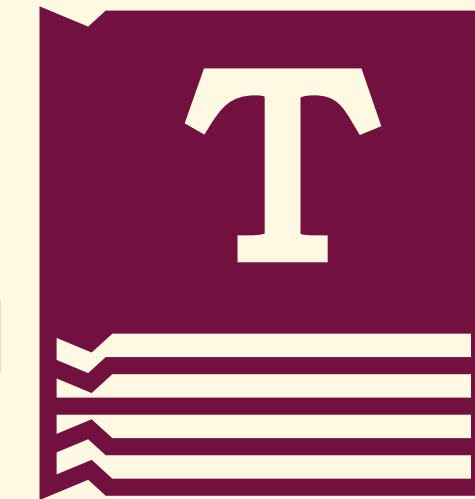
BATTERY INDICATOR ON BOTTOM

## QUICKSTART GUIDE

WE CONDENSED OUR MANUAL FROM 16 PAGES DOWN TO TWO BY FOCUSING ON THE MOST ESSENTIAL SECTIONS.

THIS UPDATE WAS BASED ON FEEDBACK AND OBSERVATIONS SHOWING THAT USERS MOSTLY NEEDED QUICK HELP WITH THE DEVICE'S CORE FUNCTIONS. MOST INTERVIEWEES DID NOT USE THE OLD MANUAL!

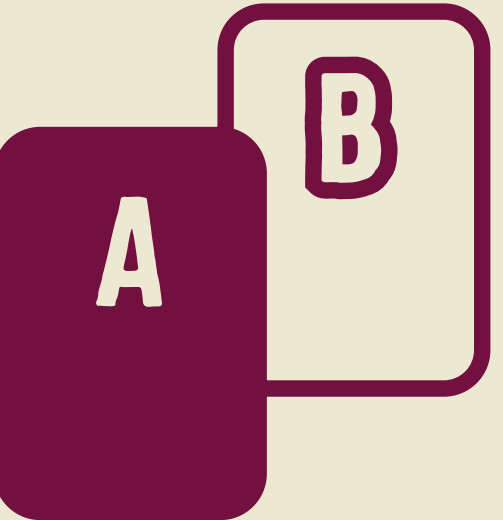
WE DESIGNED THE MANUAL WITH A CLEAN, ATTRACTIVE LOOK TO ENSURE IT'S BOTH EASY TO USE AND APPEALING TO READ.



## CODESIGNS

IN ORDER TO TEST MULTIPLE DESIGN ITERATIONS, WE CONDUCTED AB TESTING DURING OUR INTERVIEWS.

OUR TEAM INTERVIEWED OUR COMMUNITY PARTNERS AT SONRISAS QUE ESCUCHAN AND ANALYZED INTERVIEW DATA FROM THE CONFERENCE FOR GLOBAL HEARING HEALTH (CGHH) CONFERENCE, WHICH WAS ATTENDED BY THE TEAM LAST SEMESTER.

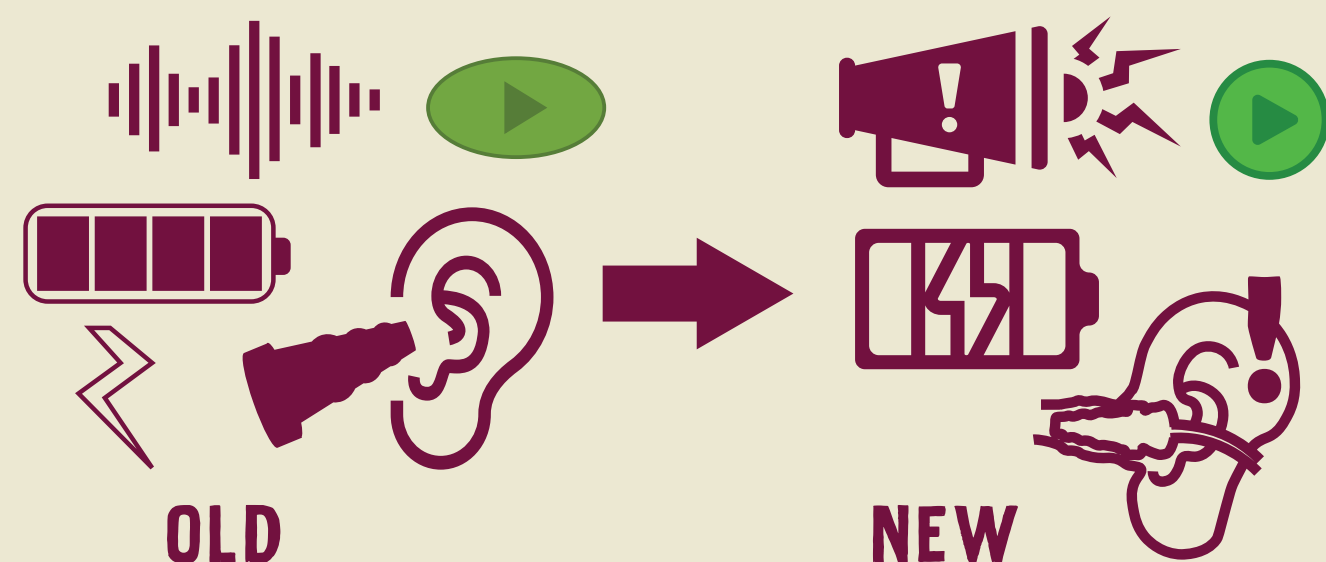


THROUGH INTERVIEWS, WE MET XIMENA MUNOS, A GUATEMALAN FIELD TECHNICIAN WHO CONDUCTS DOZENS OF HEARING SCREENINGS A DAY.



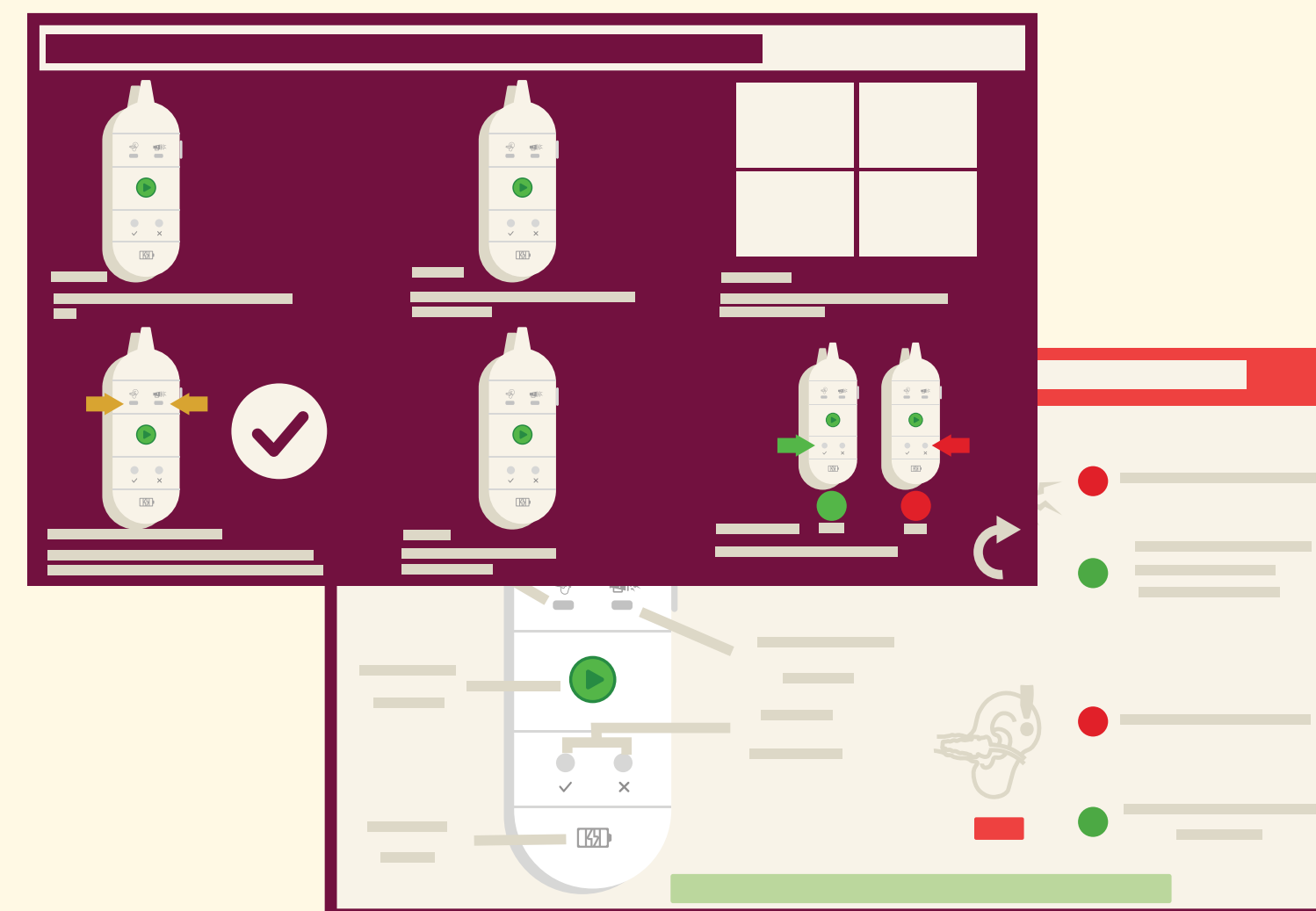
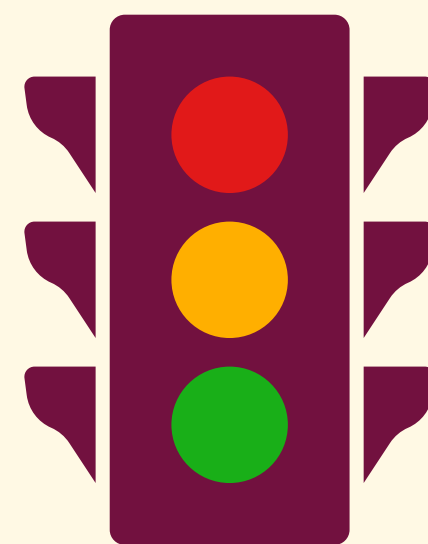
## SYMBOLS

WE TESTED VARIOUS NEW ITERATIONS OF DEVICE SYMBOLS, IMPROVING CLARITY AND USABILITY.



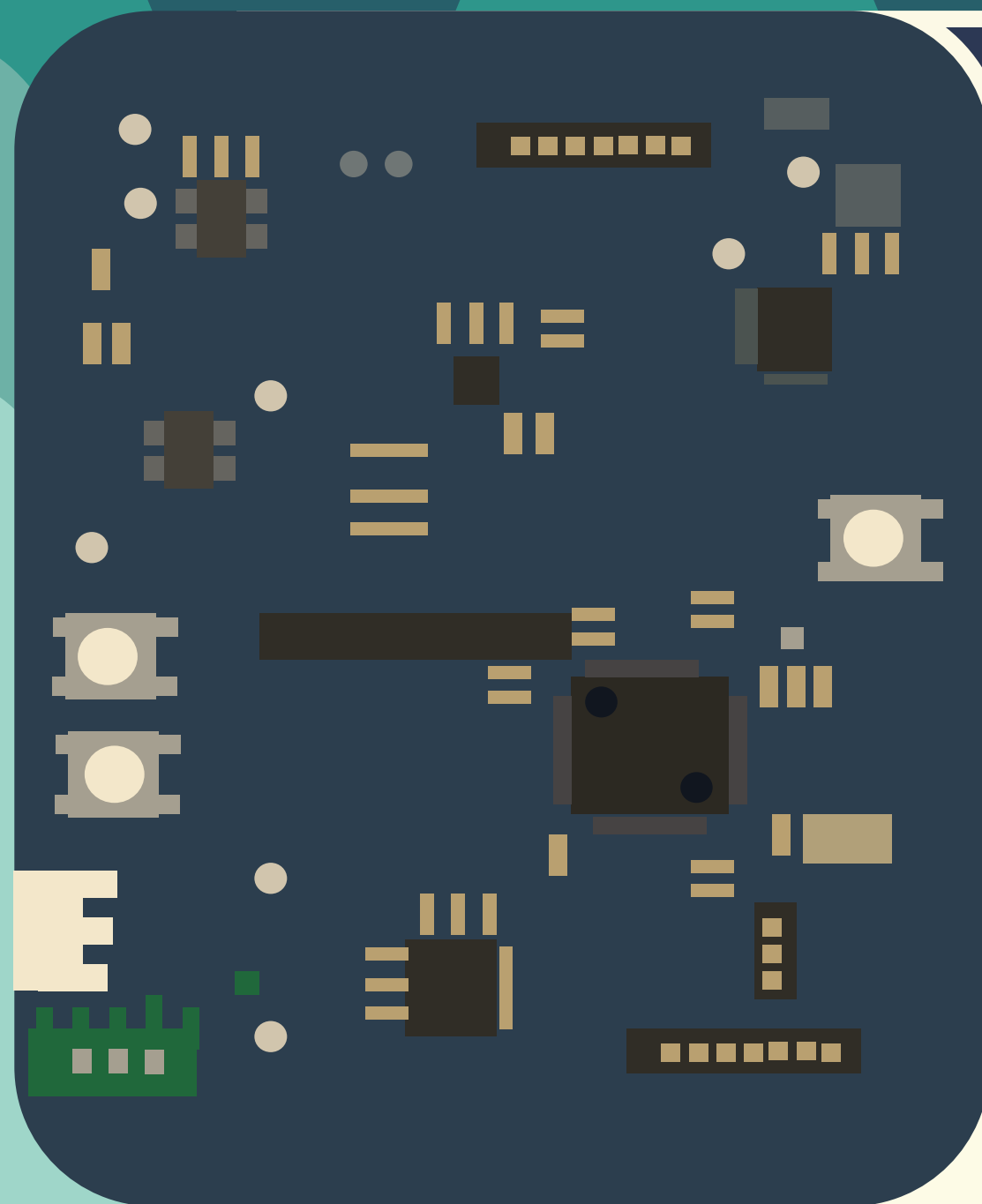
## COLORS

13/15 INTERVIEWEES WHO FAVORED GREEN AND RED COLOR SCHEME TO INDICATE AFFIRMATIVE AND NEGATIVE.





# DEVICE PROGRESS



## CURRENT CIRCUIT BOARD

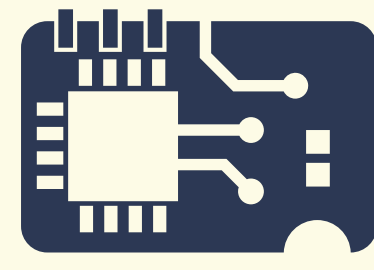
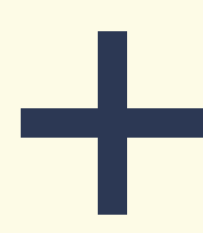
UTILIZING HARDWARE DESIGNED OVER THE SUMMER OF 2023, WE TESTED OUR SPEAKERS, MICROPHONE, AND ALGORITHM; WE HAVE MADE STRIDES IN REACHING A PROTOTYPE ABLE TO BE HUMAN-TESTED.

## INTEGRATION

FROM SPECCING OUT PARTS, CREATING A UNIFIED COMPUTER MODEL, OR FINALIZING DESIGN ITERATIONS OUR TEAM HAS BEGUN WORK ON BRINGING ALL PARTS OF THE DEVICE TOGETHER.



MECHANICAL



ELECTRICAL



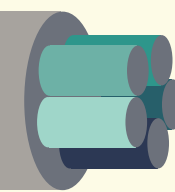
DESIGN



PRODUCT

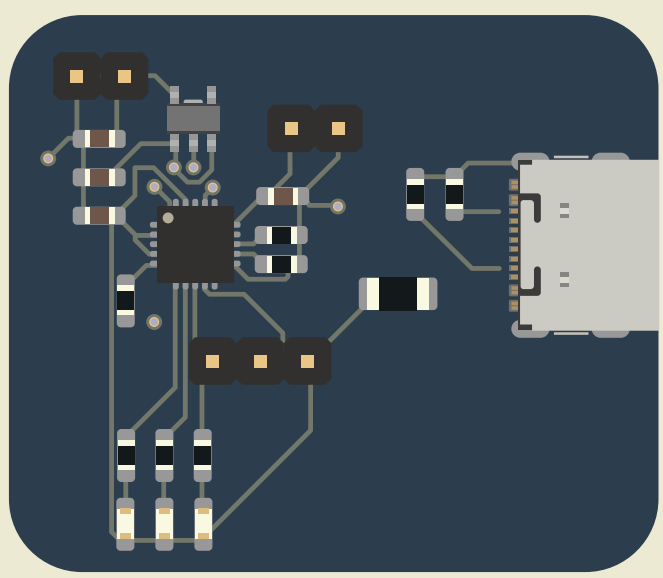
## CABLING

WE HAVE CONFIRMED THAT THERE EXIST OFF THE SHELF CABLES AND CONNECTORS THAT WE CAN USE. BY USING A FIREWIRE AND HDMI CABLE, WE CAN MINIMIZE COST AND MAXIMIZE DURABILITY OF THE MOST COMMONLY DAMAGED COMPONENT OF THE DEVICE.



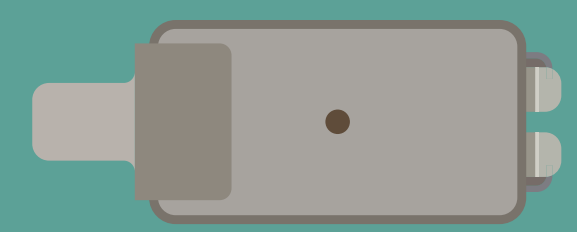
## BATTERY

WE ARE DESIGNING A BATTERY CHARGING BOARD AROUND THE MCP73871 CHIP. WITH MODEL LAYOUT COMPLETE, NEXT STEPS ARE ORDERING THE BOARD, ASSEMBLING AND TESTING IT, AND EVENTUALLY INTEGRATING IT INTO THE FULL DEVICE.

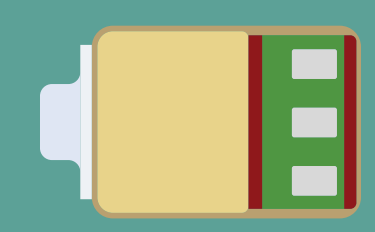


## SPEAKER & MICS

WE RAN EXPERIMENTS TO TEST OUR SPEAKERS! WE DETERMINED THAT WE CAN PRODUCE THE CORRECT TONES NEEDED TO RUN OUR DEVICE TESTS.



MICROPHONE



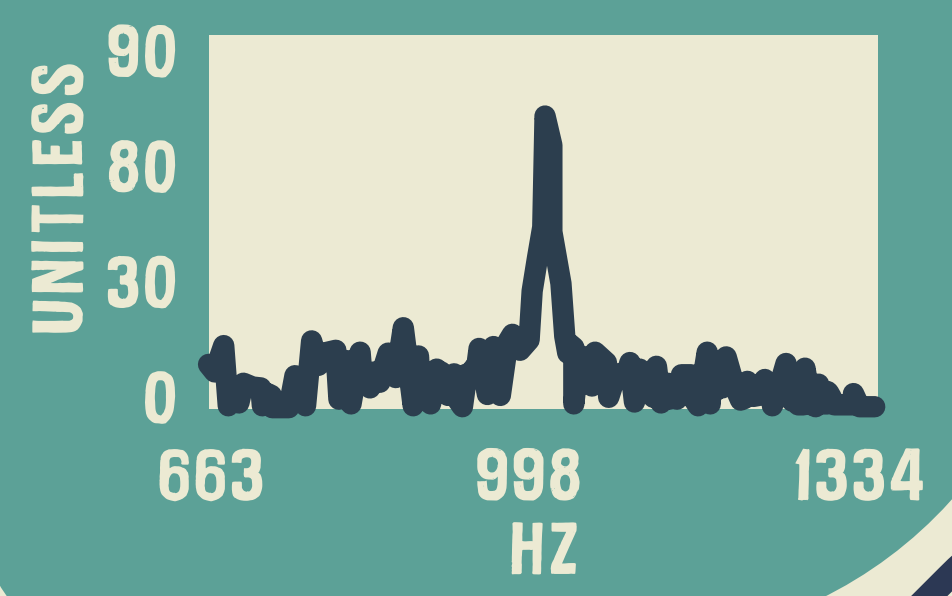
SPEAKER

OUR MICROPHONE WAS SCRUTINIZED TO CORRECTLY IDENTIFY THE TONES IT WAS HEARING. OUR GOAL WAS A 1 KHZ SIN WAVE, AND WE WERE WITHIN ACCEPTABLE MARGINS OF ERROR FOR THIS. WE ALSO SUCCESSFULLY GOT AUDIO OUT OF OUR SPEAKERS USING LARSON DAVIS TEST EQUIPMENT.

## TESTING

WE USED EQUIPMENT FROM LARSON DAVIS TO SIMULATE SOUNDS AND ADMINISTER VARIOUS TESTS TO HELP CALIBRATE OUR DEVICE.

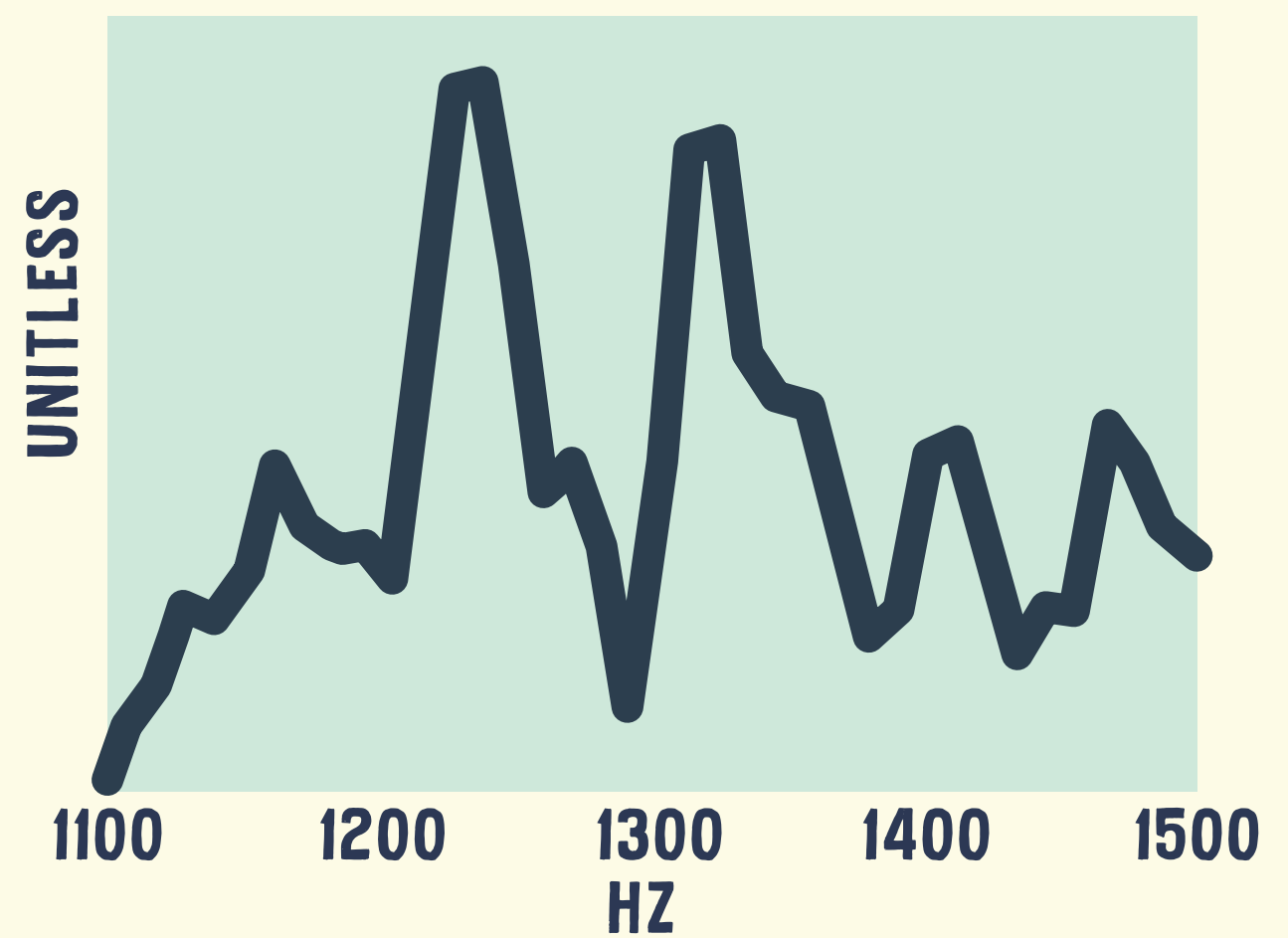
### FAST FOURIER TRANSFORM LIVE



## ALGORITHM

THE RESULTS PICTURED IN THE GRAPHICS BELOW IS OUR IDEAL HARDWARE OUTPUT. TESTING IS UNDERWAY AND WILL CONTINUE NEXT SEMESTER!

### UNFILTERED TEST FREQUENCIES



### TEST FREQUENCIES WITH NOISE REJECTION

