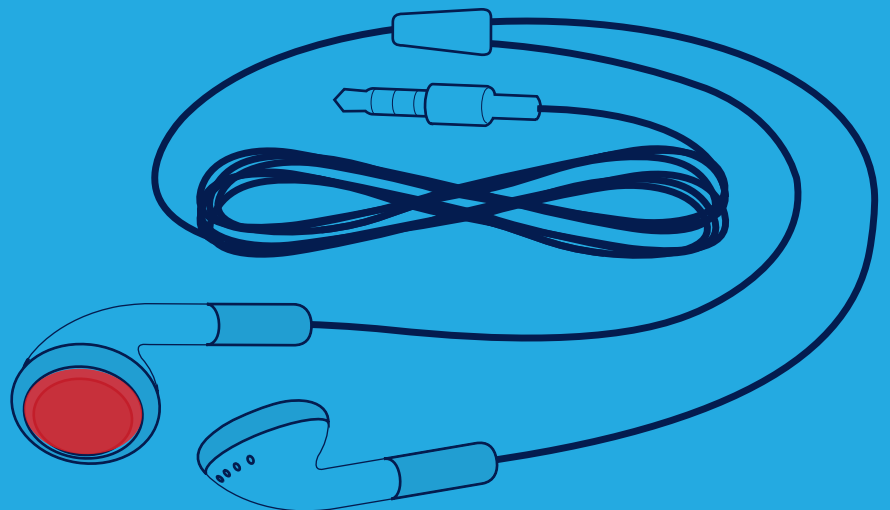


UNDERSTANDING NOISE INDUCED HEARING LOSS

Observing Users Research Report, Spring 2012
Prepared by: Caroline DeWick



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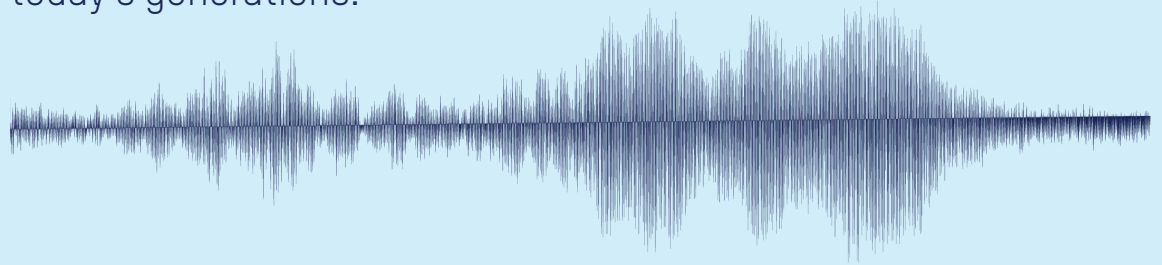
INTRODUCTION

Problem:

Hearing loss is a major public health problem in the United States. One in 8 American adults recently reported having hearing trouble, and this number rises to 50% of individuals aged 75 years or older.

Hearing impairment imposes a substantial burden on individuals and society, and is associated with poorer quality of life, increased depression, greater difficulties with functional activities, and lower income.

Studying and understanding the impact that headphone use has on Noise Induced Hearing Loss (NIHL) and exploring what can be done to spread the word about protecting hearing health was the goal in uncovering exposure problems and possible solutions for today's generations.



This was a joint project between Caroline DeWick and David Marthan as part of an Observing Users course at the Institute of Design, IIT.

The topic of headphone use and hearing loss was selected after several brainstorming sessions and eventually chosen due to its sticky nature and unfamiliarity. Once research started, it became clear that the issues and statistics associated with hearing loss were quite shocking and seemingly ignored in today's marketplace. Technology and capabilities of electronic devices and audio equipment have evolved quickly, but have left the associated problems and health concerns in the dust. Most of the population has little or no regard for their hearing health, or at the very least, are unsure of how to really take care of it. This project aimed to understand why that is and how this mind-set can be changed, and also to see what opportunity spaces exist for the headphone market.

A total of twelve weeks of research were completed to get a grasp on hearing health awareness and headphone user behavior. Participants were recruited from around the world to help this cause and industry professionals were also interviewed to provide a full spectrum of understanding. This report summarizes the research findings, explains the methods performed along the way, and identifies shortcomings and recommendations for continued study.

PROJECT CALENDAR

February 5 - April 21, 2012

Feb 5	6	7	8	9 Research Plan due	10	11
12	13	14 * Conduct interviews	15	16 Informational interviews due	17	18
19	20	21 * Conduct interviews	22	23 Ethnographic interviews due	24	25
26	27 * Recruit participants	28	29	Mar 1 Prepared probe for deployment	2	3
4	5	6	7	8	9	10
Probe deployed						
11	12	13	14	15	16 * Schedule Contextual Inquiry	17
Spring Break						
18	19	20	21	22	23	24
Contextual Inquiry			Probe analysis, interviews			
25	26	27	28	29 Probe results and Contextual Inquiry due	30	31
Apr 1	2	3	4	5 User Journey map due	6	7
8	9	10	11	12 Thick Description due	13	14
15	16	17	18	19 Start final report and draft poster	20	21

RESEARCH PLAN

Objective

The goal of this project was as follows: Investigate problems related to NIHL and headphone use: physiologically, psychologically, and cognitively. Uncover noise exposure problems and causes among today's younger generations. Propose alternatives and solutions to the increasing NIHL rates. More specifically:

- understand associated behaviors of headphone users
- uncover what users know about hearing health
- explore the role that headphones and media play in a user's life

In order to gain clarity and direction on these topics, observations and interviews were performed on a diverse group of headphone users and hearing health professionals. The following activities also helped develop insights:

- identifying user typologies
- performing intercept interviews with people using headphones in public
- browsing hearing-health related websites
- visiting an audiologist's office
- investigating different mobile devices and their volume parameters
- researching what a hearing test involves

Methods

Specific methods used to uncover behaviors, awareness, and core values associated with headphone use involved the following:

Informational Interviews
Ethnographic Interviews
Digital Cultural Probe Deployment
Contextual Inquiry
User Journey Mapping
Thick Description

Approach

Research kicked off with informational interviews in which strangers were recruited to answer a few questions. Participants were screened as careful listeners or extreme listeners based on their answers and were

further mapped into semantic profiles based on their responses. These interviews formed a base set of information that was then used to recruit further, and more specific, participants for ethnographic interviews. Combined, results from these interviews provided intriguing information on peoples' knowledge of hearing health and habits of headphone use.

These topic areas were further explored with a digital probe which reached participants across the globe. Asking participants to actively upload to a web-based forum brought in information that may not have been captured otherwise.

A contextual inquiry and journey map then helped to further outline the headphone experience and see first-hand how users were behaving. Spaces for opportunities were revealed and developed as insights from these activities were clustered.

Lastly, a thick description was performed to look back at participants and interviews in order to dig deeper into previously unexplored territory. New insights were uncovered and the process as a whole helped to tie together and conclude the project in a meaningful way.

Findings were then presented in poster form as a way to communicate the project to a wider community. This final report serves as an introduction to the next stage of design; solution development.

Research Questions

- What do people know about hearing health?
- What are headphone users listening to?
- What is the typical volume level? Can this be regulated for certain age groups or users?
- Are there common users of headphones and earbuds? Is there a particular type or brand of headphones used among extreme users?
- Does location or time of day depict common patterns among users?
- What measures need to be taken in order to lower the rate of 1/8 people with NIHL?
- Are headphone users aware of what NIHL is and what related terms, like sodcasting, means?
- What is the best method to alert adolescents and young adults to NIHL?

METHODS & ANALYSIS

Informational Interviews

Participants were recruited for questioning at the Merchandise Mart on Wells Street in Chicago. They were all students at the Art Institute. Each was categorized as an extreme or careful listener to better probe them on headphone use and habits.

Users

Extreme users were identified as those who use headphones to listen often and listen loudly. They are characterized by the phrases "I don't think about how loud my media is, I just turn it to where I enjoy it," and "I like to turn up my media as loud as I can."

Careful users were identified as those who use headphones often, but are cautious about listening habits and volume levels. They are characterized by the phrase "I am careful about volume, I turn it up only so I can hear my media over my surroundings."

Key Observations

- Curiosity

The participants were willing to answer questions mostly because they were curious about the topic. Most had no direct relationship with people suffering from hearing loss and were surprised at the statistics revealed about youth and hearing damage.

- Entertainment

All participants were listening to music. Some noted that they would listen to podcasts or books, but most were passing the time with songs. Extreme and careful listeners alike got annoyed with other people turning their headphone volume up so loud that others could hear. This seemed to either influence them to turn theirs up as well, or to simply think, "wow, that's bad for your ears."

- Isolation

Several of the participants noted that they use headphones as a signal to not be disturbed. They said this could be both a good thing and a bad thing. One extreme user commented that she likes being left alone, but that "in an emergency, someone would actually have to reach out and touch me to get my attention."

- On The Go

Participants were all going to or from class. They used headphones to listen to their favorite songs and relax from a busy day, or to distract themselves

from thinking about homework. They reported that they are usually plugged into their devices with headphones when on such errands and one user said, "I'm always connected wherever I go."

Interesting Moments

- Not Cautious About Other Sounds

When careful listeners were asked if they were careful about the other things they play music on or listen to, they said they were not actually as vigilant with volume levels. A few said they will play their stereos as loud as they like or do not even think about television sets or other appliances. A few of the participants noted that they have to be careful about what they play at home due to neighbors and time of night.

- Hearing Tests

Most of the participants last had a hearing test in elementary school. One careful listener commented that she had one in high school. An extreme listener said that he actually had a hearing test in tandem with an eye exam just 6 months ago. Most of the participants had not thought about a hearing test in years, nor did they think about how it might be as important as an eye exam or dental visit.

Insights & Surprises

- Being In A Different World

Though many participants noted privacy as a benefit of headphones, two of the extreme users specifically commented on how enjoying music brings you to your "own place with no worries about what's going on around you." One user even commented that he would be lost without his headphones and that his "mind would be in a different world." Yet another commented that she would get anxious and worried without being able to plug in.

- Family Members with Hearing Problems

One careful listener told us that her mother is



METHODS & ANALYSIS

Informational Interviews (cont'd)

deaf in one ear. This made her very aware of how she uses her earbuds and to what volume she plays her stereo in her room. She added that her sister did not have the same caution though, and would play her music at top levels. Also, her frequency of use was one of the lowest of all participants. She said she only uses them when on her way to school 2 days a week for 15 minutes at a time.

- Special Features

When one extreme user was asked whether he was aware of volume control features on his phone that he was using to listen to music, he went into detail about the equalizer capabilities. He was very interested in music and had several musical devices at home, including drum machines and DJ spinning tables. He was not aware of volume control but was slightly careful with his ears. He claimed the hat on his head created enough of a buffer for his headphone volume to not effect his hearing health.

- It's a Myth?

One extreme user said that he believed that hearing damage caused by earbud use was a myth. He did not think that volume or frequency of use at his young age of 18 would have any long-term effects on his hearing health. He even kept his music playing during the interview and was the only user to report he had never had a hearing test.

changing their lifestyles to reflect any of their knowledge. Careful listeners also seemed to show more concern from observing people who listen very loudly. Some were annoyed, but several said that they felt bad for the person and what they were doing to their ears. Extreme listeners did not share this concern and were more worried about hearing their music loud and clear.

- Time Span

Extreme users were listening to devices with headphones much more frequently than careful listeners. A few careful listeners did have high frequency, but said this was because of long commutes or use during homework sessions (during which, volume was kept low). Extreme listeners also reported that during these long listening periods, they kept the volume at its max due to busy surroundings.

Conclusion

These informational interviews and the insights gathered from them helped to filter participant selection for ethnographic interviews. Developing tools to move the interview along was another consideration observed at this point.

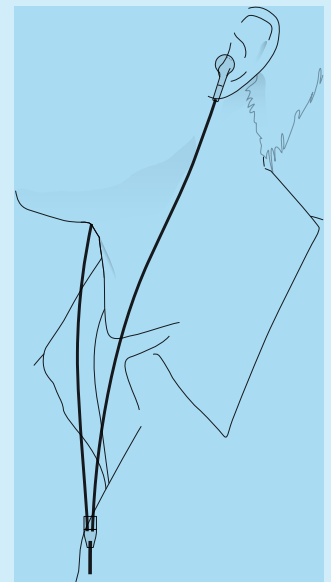
Compare & Contrast

- Extreme Vs. Careful

Out of 9 total participants, there was a nearly even balance of careful versus extreme listeners. Although all participants listened mostly to music on their mobile phones, the extreme users had a higher level of music appreciation and a more careful headphone selection. Privacy seemed to be a benefit to all but was also seen as an isolating factor which could have negative effects. Careful listeners were more eager to offer up future improvements that the headphone and device companies could implement. Some had very detailed descriptions of what earbuds should do (fit properly or be outside the ear), when devices should cut volume (at damaging levels), and to make them so others could not hear your music.

- Concerns

By nature, the careful listeners were much more aware of potential hearing damage and ear health than the extreme listeners. Extreme listeners said they knew a few things about it, but were not



METHODS & ANALYSIS

Ethnographic Interviews

A deck of playing cards was created with 5 specific activities related to hearing health. The activities were designed to be fun games that would probe participants about their senses, knowledge of noise levels, situational use of headphones, warning messages, and measures of protection they use. The purpose of this methodology was to uncover issues surrounding hearing health and provide insight on user awareness.



Overview

Ethnographic interviews uncovered interesting information when it came to where the sense of hearing ranked in a person's value system and how education and features affected their understanding and willingness to use headphones.

Two individuals were interviewed at this stage; one extreme user and one careful listener.

Findings

The sense of sight was ranked as the number one sense in terms of basic survival, and both participants reported scheduling regular visits to the eye doctor. No other sense was seen as requiring an annual checkup.

Both participants were shocked at the decibel levels of max-volume iPhone and iPod devices. Overall scoring at the decibel matching game was poor - participants had little to no idea how

to rank items. They tended to link them to emotional states (jack hammers being annoying made them rank as being louder), but no other knowledge of decibels was evident.

Activity enjoyment and productivity changed drastically when thought of with and without headphones. Headphones were seen as part of a ritual or routine when participants set out to work, exercise, or commute. Activities without headphones were seen as "missing something."

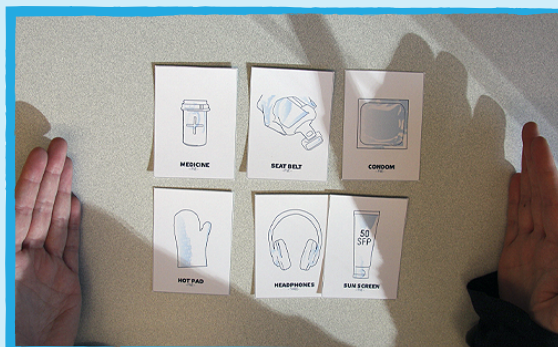
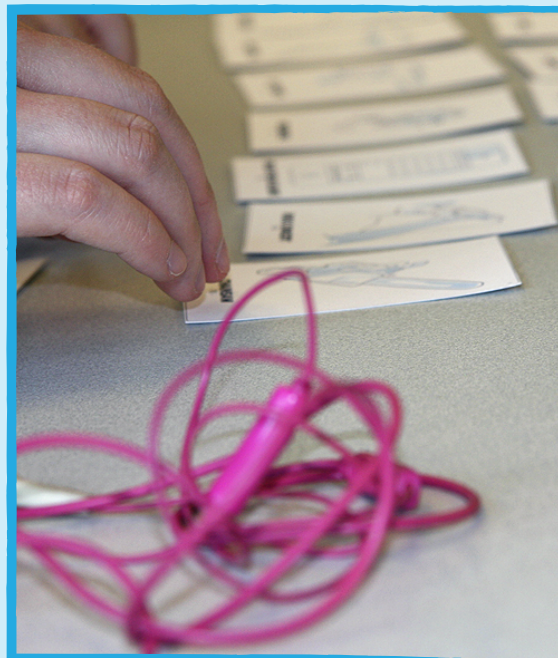
Participants differed on recommendations for addressing the lack of public knowledge on hearing health. The careful listener stressed that a public service announcement or a public campaign would enlighten the population as a whole on the topic, while the extreme listener said that awareness has to start at the device and the features it offers in order for people to wake up to the subject. Both users agreed though, that requiring a hearing test annually would not be enough.

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Ethnographic Interviews (cont'd)

The concept of protection was another topic covered with cards showing everything from a seat belt to sunscreen. The participants were asked to select 6 of the 10 items and both participants remarked that this was a very difficult task. What helped them both make their selection was ranking the items in terms of what protection could save their lives. Protective headphones or ear plugs did not make either participant's list.

Overall, the cards were an effective tool to get a lot of information out of the participants who actually knew pretty little about hearing health. Presented in game form, the cards took out the intimidation often associated with health related questions. Unique insights were gained from this exercise and helped formulate the approach to the cultural probe.



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Cultural Probe

A digital probe, in the form of a tumblr blog, was deployed to reach participants across the globe. The hope was to make their experience of understanding Noise Induced Hearing Loss immersive and interactive by encouraging active participation. The aim was also to have the probe be something that was present on their everyday devices (mobile phones and computers), in order to get their attention and perhaps impart some valuable knowledge about hearing health.



Results

Reaching participants through a digital probe proved to be effective. A wide variety of responses were sent in and populated the site daily over the week it was active. All participants were able to see one another's responses and shared in the pride of creation. The following insight clusters were found during analysis:

- No Mute Button

All participants were asked to reflect on a moment of complete silence and reflect. All said that noise or sound was everpresent - there was never silence in a day, whether it was the murmurs of city streets, or gurgling building pipes.

- Sense of Hearing Ranks Higher

Participating in the study made participants more cognisant of how much they use their ears for more than just pleasure - hearing was described as a vital sense and something that could not be lived without. This reaction to the study was much different than when informational and ethnographic interviews were performed. Topic awareness and extending the activity to a 5 day stretch seemed to influence this response.

- Where You Are, What You Do

Participants noted that headphones get used most often when they are alone or during certain

METHODS & ANALYSIS

Cultural Probe (cont'd)

activity points in their day. Working for some was seen as boring, so they put in music, others had live music at their workplace so they unplugged from their devices. Commuting was most often mentioned as a time of day where music is up and on. This observation reinforced earlier observations that headphone use is deeply rooted in routine.

- Evoking Emotion

Emotional connection was mentioned by all participants when it came to talking about what they were using headphones to listen to. Participants plugged into their devices and headphones to evoke certain feelings, or to cover them up. Boredom was lessened by listening to music through headphones. Encouragement and excitement were elicited through pairing music with volume at the gym. The probe further uncovered that sounds evoking happiness tended to be social and involve other people - strangers or friends/family. Sounds that evoked feelings of annoyance tended to be manmade things (cars, tractors, trains, door openers) that interrupted participants' days or routines. Listening selections were more often than not picked with great care due to these emotional ties.

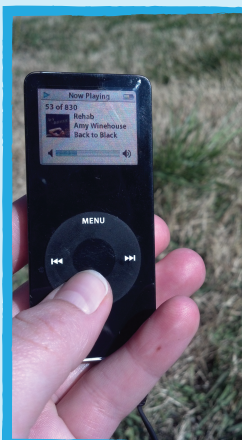
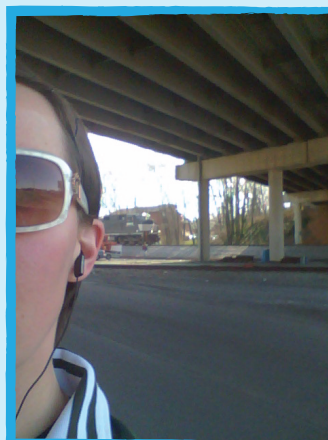
- Low Level of Hearing Health Knowledge

The probe furthered the observation that hearing health is not a topic that people are talking about or sharing concern about. Participants scored low on the questionnaire about decibel levels and other

health topics even though several articles and links to information were provided on the site. The study did, however, encourage some participants to perform further research on their own and consider how they might be hurting their ears with current habits. It also helped them understand how certain senses are interrelated, such as how important your sense of smell is in the activity of enjoying favorite foods.

Moving Forward

- **How might we** make hearing health an issue that is talked about and shared in today's population?
- **How might we** create headphones that emit high quality sound, but also take care in preserving people's hearing?
- **How might we** encourage activities like walking to work or working out to be without headphones?
- **Expert Questions:**
 1. What kind of people are predisposed to have genetic ear damage? Why?
 2. What are the parts of the ear that are affected by high volumes?
 3. Which is the most frequent diagnosis caused by excess volume?
 4. What kind of protection exists for the ear? What do different levels on ear plugs mean?
 5. It is possible to make a filter that eliminates certain harmful decibels?



Photos submitted by participant Cristelle K.
Documentation of her walk to work.

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Contextual Inquiry

A contextual inquiry interview was performed on Tomas A. during his typical day of chores and exploring the city. This method was structured as a two-hour Q&A interaction to probe about his normal headphone-accompanied activities and discusses what was seen.



Findings

- Visual Cues

Tomas intensified the use of hand and body gestures when asked questions. Though he listened at a moderately low volume, he found it necessary to exaggerate body language during the interview process and would frequently take one earbud out to listen and respond.

- Behavioral Cues

Tomas said he feels a sense of joy and nostalgia when listening to music through his headphones. He said he consciously wants to experience the music and the memories that are connected with particular songs. He actively looks for emotions and said he often bases his playlist selection on this fact. He was listening to what he called his "happy day" playlist and seemed to be in a jovial mood. He also mentioned that this helps him to do household chores - making an unpleasant task more tolerable and fun.

- Paralinguistic Cues

Tomas spoke louder than normal while wearing

the headphones and said that he usually has them in only when alone because they are such a barrier to conversation.

Interesting Moments

Tomas stated that a lot of headphone-use behavior should be common sense and proper manners. He said this may be because he is older (35), but with growing technology use everyone should be aware of what effect their habits have and take care to be polite about them.

Tomas also mentioned that headphone use should not be solely to blame for hearing health problems. He noted that large growing cities and the noises they create should be understood and studied - especially their psychological and psychiatric aspects.

Tomas started thinking about solutions to these problems as the interview went on and suggested that a headphone classification similar to sunscreen SPF rankings might help awareness.

METHODS & ANALYSIS



Thick Description

A thick description was performed to look back at interview results and dig deeper into previously unexplored territory. This thick description in particular targeted one participant who mentioned starting a family while being asked about headphone use.



Results

After probing deeper into this user's interview responses, an insight became clear: proper headphone use does not necessarily, and perhaps should not be, something that is sternly enforced upon users. Just being reminded of the fact she wanted to have children and hear their laughter every day of her life was enough to send a message to this participant. It was as if she decided at that moment that she was going to take care of her hearing health in order to be a fulfilled mother. This observation was quite a surprise and uncovered the potential to shift headphone-related product opportunities to a different end of the spectrum. Intimidating facts and statistics may not be the right way to motivate users, perhaps all it takes are gentle reminders.

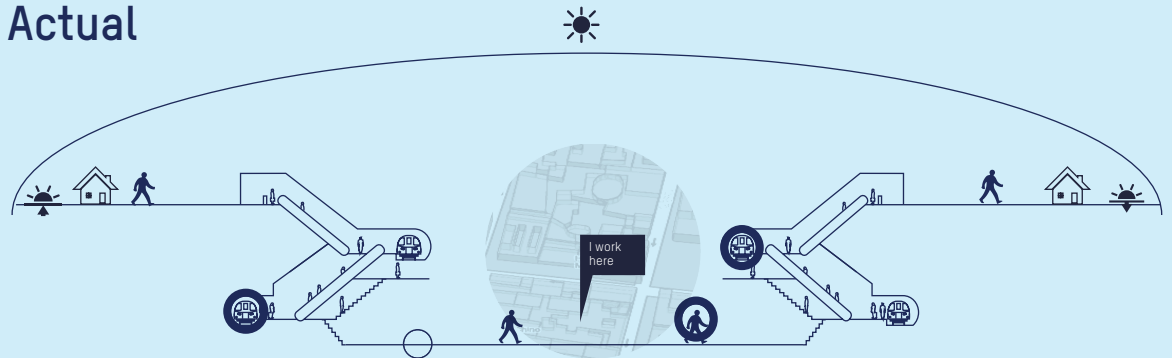


METHODS & ANALYSIS

User Journey

A typical experience of a headphone user was mapped throughout a day to understand behaviors and actions associated with headphone use. An ideal journey was then mapped once results were studied and analyzed.

Actual



- Entice

Plugging in provides a way to pass time while commuting, and a phone is especially important to provide other services while being connected.

- Enter

In general, morning users look to energize themselves and set the tone for the day through music. Volume is only considered when surrounded by a noisy environment.

- Engage

Headphones are used when appropriate

throughout the day to get concentrated and focused during work or school.

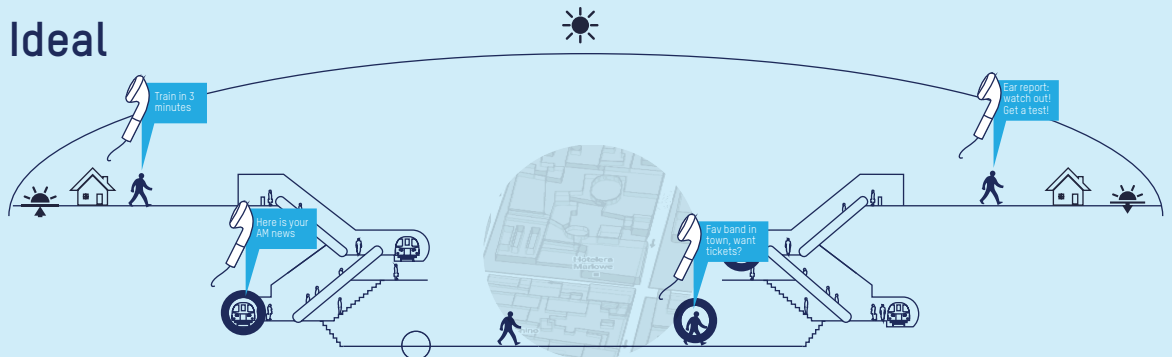
- Exit

Leaving work and returning home calls for headphone use and is part of a routine. Users look to decompress from work and relax. They often look to isolate and have playlist ready.

- Engage

The end of the day is unplugged. Users return home to rest and recharge their energy and also recharge their cell phone for the next day.

Ideal



- Entice

No preparation necessary. Headphones know user and their wants. Easy, intuitive.

- Enter

Headphones learn routine and tastes. Know what to play to wake user up and adjust to surrounding sounds automatically. They play clearly, but do not harm your hearing and are programmed to warn user if levels exceeded.

- Engage

At work, headphones recharge and continue to curate for user (playlists, new bands, etc).

- Exit

Headphones once again know habits and preferences. They talk to device, play user's likes, and alert user of any new music or events.

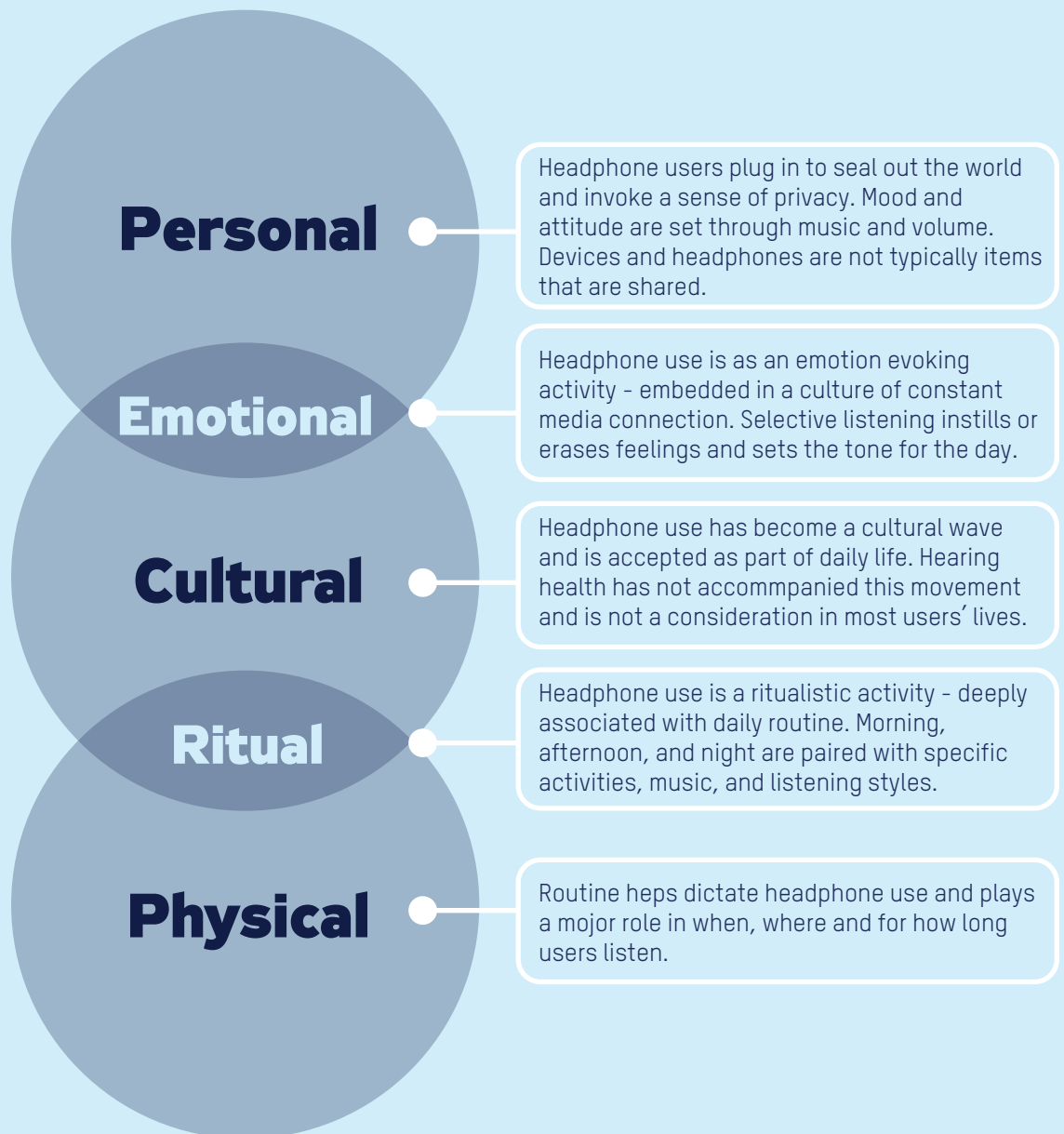
- Engage

Each day headphones get to know user better and can track hearing health and volume levels. They keep user informed while entertaining.

OBSERVATIONS & THEMES

Core Values

Analysis of findings from all research methods cumulated into interesting areas of insight. Users, though widely diverse in taste, listening styles, and geographic location, shared common beliefs and standards when it came to their headphone use and values. The five underlying value systems are outlined below.



Shortcomings

Headphone use and hearing health awareness were found to face many challenges, especially when thought of in tandem.

- One Way Communication

Headphones are currently a device that allow a user's device to communicate to them. No feedback loop exists for users to return any messages themselves.

- Hearing Health is not a Concern

Headphone users are only aware of volume levels and their impact if they have been exposed to information in their past that tells them so.

- Devices Lack Protective Features

Often, users had no idea that their mobile devices used with their headphones had capabilities to limit levels.

- Hearing Tests Not Required

Though required hearing tests may not be

the answer to increase awareness and care, some wide-spread method to make the ear an organ people actively take care of and check up on is needed.

- Headphones Force Isolation

When users are plugged into their headphones they are not tuned in to their surroundings. Though some crave this privacy, it can be cause for dangerous situations or frustrated users.

- Require Preparation and Forethought

Headphone use is often part of a daily routine but requires users to think ahead to when they need to unravel them, what to have prepared to listen to, and when they have to adjust volume. This process could be more seamless and user-centered.

Opportunities

The industry for headphone products and accessories has many opportunities for innovation and improvement ahead. The capabilities headphones could have in relation to hearing health is vast and should be investigated further.

- Feedback Loop

Headphones are already connected to some type of media device, most often a cell phone, which can offer opportunities for a user to "teach" headphones their preferences, tastes, routine.

- Built-in Alerts

Headphones could offer the ideal medium for hearing health related statistics to be communicated back to the user.

- Partnership with Media Devices

Devices, when paired with headphones, could offer expanded features related to hearing health and improve and advertise these features more prominently.

- Cultural Wave

As headphone use has become a cultural wave, so should protecting your ears. Once seen as a trend, the masses are more likely to jump on board and adapt their styles to be healthier.

- Companion

Since headphones and the ritual of listening is so deeply rooted in a user's day, the idea of a nurturing companion should be explored.

- Intuitive

Headphones that are able to react to a user's surroundings without concern about speaking louder or frequently adjusting volume should be investigated.

CONCLUSION

Understanding NIHL

Headphones have a major presence in today's population. Though not the only device that can cause hearing damage, they are certainly among the top contributors to growing hearing health problems. This is concerning, especially when those using them do not realize the impact they are having on their future ability to hear sounds clearly and fully.

Finding a solution to this problem that is not overbearing nor overlooked will be vital in turning the shocking statistics around. Headphones themselves have many opportunities for improvement that could foster a user's existing routine, support their emotional needs, and also inform users of what their listening styles are doing to their ears.

In sum, changing the mindset about hearing health needs to start somewhere, and headphones offer a very large group of users in which to get going. Even if users adopt future headphones because of innovative, interesting features, they could by proxy adopt the added capabilities of being informed about hearing health. By providing the tools to properly maintain hearing health directly at the source, people will find it simple to adapt, invaluable to change, and impossible to ignore.

