Assistive Technology Is Worthless If It Is Not Accessible

Elizabeth Ericksen
eee.isc@gmail.com
Foothill College

ABSTRACT

Like small robots riding on their user's ears, Bluetooth enabled hearing aids when paired to a smartphone enhance wearer's lives with adaptive hearing features, audio streaming, and health monitoring. However, along with their benefits come accessibility challenges. Drawing from personal experiences, I explore the benefits of modern hearing aids and highlight failures in Bluetooth connectivity as a common roadblock for their full feature usage. This paper is meant to raise awareness of the complexities surrounding the use of assistive technologies and to stimulate discussion on the need to make them fully accessible for their users.

KEYWORDS

human robot interactions, assistive robotics, accessibility

1 INTRODUCTION

Two little robots sit on my ears during most of my waking hours. For some of our interactions the three of us must communicate through an intermediary: an app on my smartphone. My two little robots are hearing aids. While hearing aids might not be traditionally thought of in terms of human-robot interaction, mine come with a "unique on-board Deep Neural Network ... accelerator engine that mimics the cerebral cortex of the human brain to help fix what years of hearing loss have broken [1]."

I was diagnosed with hearing loss seven years ago. I am on my second set of hearing aids, this time Bluetooth enabled. A former software engineer, I know how to troubleshoot technology when it doesn't work well. Not all hearing aid users can. I am going to illuminate connectivity issues that ultimately become accessibility issues for many users of modern hearing aid features.

2 TECHNICAL CAPABILITIES

Used on their own, modern hearing aids help a person who is hard of hearing hear better. When paired with a smartphone app, they also offer a rich set of features that include:

- Monitoring and creating physical health reports by tracking activities such as walking, running, and biking.
- Monitoring and creating hearing health reports by tracking hearing aid usage and time spent in conversation.
- Changing to pre-set sound settings designed to optimize hearing in different environments.
- Translating a language spoken into the phone to a preferred target language.
- Creating reminders to do things like take medications, clean hearing aids, and exercise.
- Detecting falls and sending a text alert to a designated contact list.
- Pausing and restarting music with gesture control by tapping on a hearing aid.

All this technology is great when it works. However, when it doesn't, it is a source of frustration and is inaccessible to people who could benefit from it.

3 WHEN TECHNOLOGY DOES NOT WORK

In our ever-connected world, new assistive technologies will need to be connected to other devices. The problems encountered with my hearing aid usage may be generalized to other connected assistive technologies.

To be able to access the assistive technology in my hearing aids, the following must occur:

(1) The hearing aid(s) must be powered on and Bluetooth paired to my smartphone.
(2) The smartphone must be powered on and the hearing aid app must be running.
(3) The smartphone must have a connection to the internet either via a cellular network or WiFi.

Obviously, Bluetooth connectivity requires working hardware, but it also requires software that allows the connected devices to communicate. When smartphone manufacturers release software updates, it can cause Bluetooth connectivity issues for hearing aids. Many Bluetooth connectivity problems are related to smartphone software updates. These software updates go unnoticed by typical smartphone users and they are confused as to why their hearing aids suddenly do not pair with their smartphone. Less often, there are software updates to your hearing aids. Sometimes a user gets confusing warnings that pop up on the app such as, "Attention, unexpected app error has occurred: 'failed to initialize base objects on initial aid connection'" and have no idea what they mean because everything seems to be working.

If a person is not technical, problems associated with this may feel insurmountable. Not everyone is able to follow YouTube videos to fix the problem. A call for support to a hearing aid manufacturer (only during 7:30AM - 5:00PM CST, M-F) may result in long wait times or talking to customer support representatives who do not understand the problem or have the ability to explain it to a customer. Once when dealing with Bluetooth connectivity issues, a customer support person told me to use the companion smartphone app to run diagnostics on my hearing aids. I had to explain that without Bluetooth connectivity, I could not do that.

You may get lucky and talk to a very knowledgeable customer service representative who can walk you through force stopping and restarting applications, unpairing and repairing hearing aids, and in some instances clearing data from the storage area of the companion app. This can be an almost 20 step process. Sometimes you need to restart your cell phone, or you need to restart your hearing aids, or you need to restart both. If all else fails, there is a 117 page hearing aid app user manual.

Bluetooth reconnection should not be a difficult or time consuming effort for users.

Worse yet is the case where a feature is expected to be working and the user does not even realize that their hearing aids and the smartphone are not connected. For example, if I go upstairs in my home, I do not always carry my smartphone with me. If I were to slip and fall down the staircase, the fall alert would not work. I would probably hear something like "alert failure" in my hearing aids, but no fall alert would be sent. If a wearer of hearing aids has balance issues and is a candidate for falls, believing that the fall alert feature is working when it is not can create a false sense of security for both the user of the feature and their designated contacts.

3.0.1 Switching from WiFi To Cellular Data. I can be streaming music on my phone via Bluetooth as I step out the front door. When my phone switches from WiFi to cellular, one or both of my hearing aids lose their Bluetooth connection. This is usually solved by powering off each hearing aid and then powering them back on. There is a rocker switch on the top of my hearing aids consisting of two small oval shaped push buttons. It is not easy to select them by touch alone. If you have gloves on, you need to remove them. Sometimes, I instead need to "power cycle" my hearing aids by putting them back in the charging station, but this is very inconvenient when I am not near it.

Sometimes even that does not work and I need to have my smartphone forget the hearing aids, restart my phone, and then re-pair my hearing aids. This constant restarting and re-pairing can be confusing for anyone, but for many older adults who are not tech-savvy, the frequent difficulties associated with pairing their devices makes them embarrassed to be constantly asking for help and they end up not using their hearing aids at all. They may even think that they broke them.

3.0.2 BlueTooth Drops While Driving. I frequently use Google Maps for navigation in unfamiliar locations. At first I thought it would be great to stream the audio directly to my hearing aids because I would be able to hear it better. After having it drop several times, leaving me unable to hear the navigation commands, I use my smartphone's speakerphone option instead.

3.0.3 Interference From Other Devices. There can also be interference from other devices. You need to make sure that previously paired devices are unpaired. For instance, if I forget to unpair my hearing aids from my iPad and later walk near the iPad with my hearing aids paired to my smartphone, inevitably one or both hearing aids drop connectivity with my phone. If I do not notice this, I may miss phone calls.

3.0.4 Not All Features Work. The Tap Control function of my companion smartphone app for my hearing aids does not work for me. After setting up Tap Control, I am supposed to be able to pause streaming by tapping my hearing aid. The ability to do this is convenient if you are out for a walk and streaming music and encounter a neighbor that wants to talk to you. However, because this feature does not work, I need to whip out my smartphone along with my reading glasses to see what I am doing. It would be much easier if I could use Tap Control to pause the streaming without fumbling to use my cell phone.

I am obviously not alone in this. A fellow Reddit user posted, "Has anyone had any luck with the start/stop audio tap control on their . . . [hearing aids]? I've got it set up in the app but tapping the [hearing aid] just results in the audio stream pausing, a series of 4 beeps, and then the audio resumes. [2]"

When I jog or power walk, the audio streaming starts lagging or stuttering. I do not have this connectivity issue with other headphones when working out. Additionally, with other headphones, I can turn the music off with the touch of a button if someone is talking to me.

3.1 Recommendations

While my experience highlights the potential of modern hearing aids, it also exposes significant challenges in their reliability and accessibility.

Hearing aids are designed by engineers, scientists and programmers: all analytical types of people who generally have good problem solving skills. Not all the users of the technology that they produce have the education, experience, or background to navigate technology issues that arise. What is intuitive for a younger person may not be intuitive for an older person.

Bluetooth enabled hearing aids can be a blessing for people who are hard of hearing, but older adults and people who are not tech-savvy may get frustrated with them. After once or twice asking for help on fixing connectivity issues, they may become embarrassed and quit asking for help, and miss out on many good features. Designers need to remember that what is intuitive for them is not always intuitive for the users of their products. They need to employ non-technical users in more robust testing of products before they roll them out.

Smartphone carriers and hearing aid companies need to coordinate updates that affect Bluetooth connectivity. Programs that need a restart to work correctly should automatically do this without intervention on the part of the user.

Reliability, Availability, and Serviceability (RAS) are a set of attributes originally defined by IBM for its mainframe hardware. Today these terms are relevant to software as well. Reliability refers to the ability of computer hardware and software to behave consistently. In theory, a reliable product has no errors. Availability refers to the time that the product is operational. An ideal high availability product is always operational. Serviceability refers to the ease with which a product can be maintained. These are good goals to have for the design of any product. But when it comes to the design of assistive technologies, one other metric is equally important: Accessibility. If a person cannot understand how to use a product, it is not accessible. Thus, a better product development framework would be: Reliability, Availability, Serviceability, and Accessibility (RASA).

3.2 Conclusion

When technology works, the bells and whistles can be amazing. Bluetooth enabled hearing aids can make a wearer's life easier because connecting to other devices can turn them into a wireless headset. This allows one to hear phone conversations better, and listen to music, podcasts, and audio books on their hearing aids. However, Bluetooth connectivity can be unreliable even with the latest AI enabled hearing aids. Inaccessible features, no matter how wonderful, do no one any good.

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