12-11-2019

Is Innovative Auditory Technology Here to Stay

Krish Galani
Rochester Institute of Technology, kdg1602@rit.edu

Is innovative auditory technology here to stay?

A multiperspective study exploring the effect of new technology on the hearing impaired

Krish Galani

Rochester Institute of Technology

Introduction/Literature Review

Innovation is often seen as a necessary constant throughout history, as it is our survival mechanism, evolving from humanity's inherent ignorance/flaws. However, as society pushes for innovation at an ever increasing rate, should we be concerned about its implications on the deaf and hard of hearing (DHH) in the United States? The DHH have been quite sensitive to this surplus of innovation, with an increasing amount of 'auditory aid related' technologies being marketed everyday. What does this mean for deaf culture? More importantly, how will these innovations shape the future of deaf behavior and linguistics? We all have our own reliance on technology, however the DHH community require relevant, tailored devices that serve their purpose in all kinds of exchanges. Whether or not we realise, society, especially the DHH society, is becoming increasingly dependent on innovative digital services. This is due to their culture, as their social view encourages making accommodations for deaf people so that they can fully participate in society. Such services provide a proxy for their cultural barrier, promote the full progressive integration of the DHH culture into the general population lifestyle, education, business, when made appropriately accessible. Information regarding new functional developing technologies is invaluable to the DHH, not only for personal, but professional advancement. Some successful digital services include video relay and unique video phone softwares (common methods of discourse used by deaf people to conduct all sorts of communication). This research paper will provide a creative overview of what deaf technologies were effectively used in the past and today, in connection with the latest auditory inventions and their potential influences.

More blatantly speaking, can the technological advancements of today, such as a digital interface that translates sign-language, a hearing-aid, etc. which enables dialogue between the hearing impaired and the articulate hearing world, effectively serve their intended purposes like reducing the former's inherent degree of ignorance (discriminations and misconceptions), and immersing cultural backgrounds? In doing this I will also be investigating the acceptability of these newfound communications through interviewing specific non-partisan deaf candidates, and referencing scholarly sources.

Deaf culture has been adapting at a superior rate in recent decades, according to researchers Linda Gottermeier and Bonnie Bastian at Rochester Institute of Technology's National Technical Institute for the Deaf. As stated in the guide *"Deaf Technologies",* under Apps and New Technologies, "New technologies are being developed all the time." Such technologies range from "sign language, speech, text-to-voice, and other apps." To verify the extent of influence of such technologies on the DHH community, I will be exploring the effect of these digitally-centered communication mediums specifically on interactions between the hearing-abled and impaired, while hypothesizing a positive cultural impact between new technologies and deaf communication. I personally, along with others exposed to deaf communication, have exhibited increasingly pervasive innovative social mediums. Such prevalent communicative methods being used by the DHH today reflect the comfort level towards these new technologies. Closed Captioning, an interpretive visual transcript, is one of the most widespread today, with more mandates and adjustments in internet-streaming

platforms being established everyday in an effort to satisfy it's DHH presence. People also chiefly communicate through their cell phones using a variety of apps like notepad and text-

messaging. Such apps may help deaf people connect with not only their peers and the hearing-abled, but contact with online communities. Since the deaf community is relatively small, the stigma of meeting people online doesn't exist. Apps such as iPhone TapTap, The Convo Light App, and Microsoft Translator excel at mitigating the sound barrier and artificially sensitize the hearing impaired to their surroundings.

Technology has been embedded across more than just communicative mediums, but even in alert systems like alarm clocks and fire alarms, appealing to the touch sense. With objects like a vibrating pillow, flashing lights, or a bed shaker, often making up for the loss of a regular alarm sound. Lack of understanding about technological accessibility for the deaf causes conflict and injustice for the deaf community. For example, a significant number of deaf individuals in the UK admit that they are dissatisfied with their banks because of their heavy reliance on telephone banking and lack of assistance to deaf and hard-of-hearing individuals. ("Banks face massive payouts to deaf customers", 2012) As services were innovated, such as TTY video relay services developed to assist Deaf and hearing users in making phone calls. The Deaf person would call a toll free number and sign to an operator who would dial the call to the hearing person. The hearing person would speak and the operator would sign to the deaf person and voice for the hearing person. Every state provided a TTY for every Deaf customer due to TTY laws. Ultimately, technology innovations can serve

their purpose, but is there a line to be drawn in the future of bio-embedded emerging technologies?

Recently there have been advancements in sign-language interpretive technology, effectively substituting the role of interpreters. A technology called *'audialText'* strives to

improve communication accessibility through automatic voice recognition and wearable motion detectable smart technology. Though it is still early in development, it promises to bridge the DHH's communication gap through human interfaces with its wearable UI. This can be seen as a multipurpose platform that's attached to your body. Additionally technologies like *HandTalk, a "smart glove" that can recognize basic hand gestures and convert them into speech)* and Accele Glove audaciously appeal to the fantasy of being able to walk as a D/HH person and engage with anyone.

While gloves technologies like *HandTalk* and *Accele Glove* do enable seamlessly and cost-effectively translate sign language to an audible voice, they do have a couple shortcomings. "Their six-page letter, which Padden passed along to the dean, points out how the SignAloud gloves—and all the sign-language translation gloves invented so far—misconstrue the nature of ASL (and other sign languages) by focusing on what the hands do. Key parts of the grammar of ASL include "raised or lowered eyebrows, a shift in the orientation of the signer's torso, or a movement of the mouth," reads the letter. 'Even perfectly functioning gloves would not have access to facial expressions.' ASL consists of thousands of signs presented in sophisticated ways that have, so far, confounded reliable machine recognition. One challenge for machines is the complexity of ASL and other sign languages. Signs don't appear like clearly delineated beads on a string; they bleed into one another in a process that linguists call "coarticulation" (where, for instance, a hand shape in one sign anticipates the shape or location of the following sign; this happens in words in spoken languages, too, where sounds can take on characteristics of adjacent ones). Another problem is the lack of large data sets of people signing that can be used to train machine-learning algorithms." ("*Why Sign-Language Gloves Don't Help Deaf People.", 1).* Such

technologies can be quite cumbersome and impartially engineered to niche audiences. Additionally if not designed appropriately, can pose a threat to learning environments, and possibly misconstrue social signals. “Deaf people or hearing people connected with Deaf people invented many of the communications technologies we used in the past or use today.” (*“Deaf Technologies”, 1)* This is a key example that in order for technology to be meaningful in deaf culture, it must be critiqued or invented by those who are literate in the respective discourse. Also there isn’t a guarantee that people would spend money on such intricately designed systems, and the only way to know for sure is from an actual survey data, and interviews. According to telephone relay statistics (middle-man interpreter telephone service) TTY/TTD use was once overwhelmingly popular within the deaf community, but reported to be rarely ever used by 70.1% of the sample. (*The Journal of Deaf Studies and Deaf Education*, Volume 19, Issue 3, July 2014, Pages 400–410) This is predominantly due to the Internet boom, been a significant tool in creating a place of equity among those with unique needs and has become an “empowering agent” for adolescents who are DHH by opening more opportunities to access information and socialize (Barak & Sadovsky, 2008; Bowe, 2002; Power et al., 2006). Barak and Sadovsky (2008) reported that adolescents who are DHH spend more time on the Internet than hearing users of the same age. The authors also suggested that the Internet could be a source of improving the well-being of individuals who are DHH. In the most comprehensive study found, Power et al. (2006) carried out a survey of the uses of different forms of text communication by 172 members of the Australian Association of the Deaf. This study not only looked at the use of electronic communication by individuals who are DHH but also explored the uses, gratifications, and implications of technology use in the deaf community. The authors found that individuals living in Australia

who are DHH are partial to a variety of electronic communication methods (e.g., SMS, TTY/TDD, relay services, fax, and computer use) and that the primary use of these technologies was to enhance sociability, followed by use in business and/or work settings. It seems that the DHH community has built a substantial reliance around technologies that work for them, of which those technologies that tend to become popular have positive factors like ease of use, and ease of distribution. Most commonly the DHH culture uses communication mediums through the mobile phone, which almost every D/HH person has.

Keating and Mirus (2003) investigated how Internet-based video communication technologies shaped the language practices of individuals who are DHH. Although a ground-breaking study at the time, these technologies were still very much in their infancy stages, and the bandwidth requirements allowing for "natural" signed communication over the Internet were not yet available to the general public. Internet-based video and video communication technologies now have faster access speeds (e.g., 4G), and devices are smaller, portable, and more personal (e.g., smartphones and tablet computers) with applications (e.g., FaceTime, ooVoo, and Skype) that are popular and widely used within the general population and perhaps similarly in the deaf community. However, such a fast introduction of innovate technologies may be prone to certain moral implications

Rather than thinking of all the good functional uses for innovative technology, what kind of ethical conflicts may arise, specially in the regard of bio-integrated technologies. The Language Environment Analysis (LENA) system is a recent technological innovation, which uses a small recording device planted on a child's chest to process language and minimize

acoustic interference. This resulting audio file can be used for a multitude of purposes like parenting, sound interpretation, and speech development in a DHH child.

"Although relatively unknown in the UK, promising initial findings from this qualitative pilot study suggest that UK parents consider LENA to be acceptable, an important first step in developing a complex intervention. Acceptability seemed to be primarily affected by parental understanding of LENA's purpose, concerns of privacy and perceived appraisal of parenting skills," (LENA, 2015) . Next in Misconceptions of the Deaf, Terry elaborates on the dynamic between a DHH person's identity and it's interactions with Cochlear Implants. "Cochlea implants are often viewed as the 'solution' to deafness(McKee, 2008) and for the Deaf, this epitomizes the way which deafness itself is popularly perceived; not as a legitimate way of experiencing and being in the world, but as a disease, something that can be 'fixed.' Yet for the Deaf, it 'is not like it(deafness) is a disease' (Interview participants 6) that needs to be fixed. (Terry, 53). While some Deaf participants in Terry's study contested the idea of wanting cochlea implants, there is obviously more to be seen here. During interviews between the Deaf and their "service provides" (tech distributers), Terry records an interesting ethical perspective: "For these participants, Deafness is an identity; it is not a disease that requires treatment. While some service providers expressed that cochlea implants have their place as a piece of technology to assist those who are deaf, particularly 'for hearing people who have lost their hearing'(Service interview participants 2 – Hearing), others argued that: 'If you are going to make a decision to have a Cochlea implant on a young child you need to sign as well[…] you can give your child everything available to them(Service interview participant 2 – Hearing).' Some service providers drew on their past experiences within the Deaf

community to critique the assumption that cochlea implant surgery during childhood is always the best option. For example, one service provider described below how: ‘I knew three people that had Cochlea implants put in by their parents and as soon as they were 18 years old they threw them away and went and acquired sign language and they are comfortable now (Service interview participant 5 – Hearing)’ “ There are more examples of these moral contemplation studies that can be drawn from, however in general service providers obviously don’t all share the same view. We can conclude from this that technology in the DHH community is intimately personable and forms identity, and the acceptability of innovation auditory technology is for the most part welcoming.

Methods:

In order to gather relevant unbiased data, I need to validate the true demand and concerns of innovative technology with those who know best: the hearing impaired. I have provided two interviews to cover the scope of information I need to justify if innovative auditory technology is here to stay, one of which covers a professional opinion, and the other being the average DHH member's opinion. The subject in which be discussed will be much about their thoughts on emerging auditory innovations, and its acceptability/impact on culture(ethics). I will provide an array of varying questions in order to gain a complete sense of his/her optimism towards emerging technologies.

Most importantly, the questions will be critical and not skewed in a way that begs the question, but will be strictly delivered with follow up prompts. Moving on, an arbitrary selection of fit candidates will be delegated by an outsider who has no knowledge of the study, in order to generate authentic results and credibility. My first couple questions aims to establish an understanding of the individual and his/her role in the DHH community. I may ask questions like "Do you have active connections within the DHH community, and have regular exchanges in your day-to-day life?". To gauge their influence and centeredness within the DHH discourse. Afterwards, I plan on getting into the tougher questions: Have any recent developments on in DFF technology impacted how you converse with your peers? This question is aimed to get an idea of their lifestyle and interacts with emerging technologies, are they actually engaging with them and thus finding an appropriate implementation for them in their lives. Are you optimistic for growth in DFF technologies? This question seeks out their initial opinions about technology and innovation in a discourse they're very familiar with, it will be interesting to see their attitude

towards the growth of technologies. Next: What misperceptions do the DFF exhibit most frequently, do you think technology plays a role in inhibiting this negative judgement? This is a delicately planted question, for if I asked it too early, research shows I'm more likely to get an undeveloped answer, whereas if I asked it too late, I'm less likely to get an original response. Ultimately what I'm looking is a personal response that reflects their experiences as a DHH person with / without the help of technology. What technologies are ubiquitous in the DHH community? In this I seek to gain an idea of what technologies seem to work, and connect those specific technologies with reasoning from my sources in the literature review. What do you engage with on a daily basis? This is one of the most important questions as it simply asks which technologies personally enhances/contributes to their lives. How do you see the future of DHH the technologies? Basically, asks for their opinion of the answer to mission of this research paper. It would be interesting to find if they have a strong idea of what it could look like. What concerns / moral dilemmas do you have regarding the digital integration of technologies with physiology and life? Such a question calls for deeper insight into the ethical stance of innovative auditory technology, I hope to find some premonitions/insecurities we shouldn't be ignoring. Do you genuinely believe innovative DHH technologies hold merit and will diversify literacies and backgrounds? This question embodies what this study's real purpose: diversifying cultures, reducing social stigma of the DHH, enriching quality of life, and most of all providing opportunity. I will probably engage in sub questions within this question due to the natural ability to evolve into a genuine coming to terms (regarding technology and its influence). Finally, in case I missed anything and to give them space to finalize their thoughts, I'm going to ask in general what else would you like to add to the discussion of emerging technologies and its

influence on the DHHs culture? I tried to make these questions as relevant to Swales's CARS as possible in order to provide a broad unbiased array of responses.

Results & Discussion :

Interviewee 1: Michael Berezyuk (Your Average D/HH Joe)

Interviewee 2: (Anonymous Interpreter)

Overall, Both interviewees were significantly favored towards optimism. The interpreter, though expressing a preference to remain anonymous, expressed a unique keenness to pursue better technologies for a medical purpose and to encourage cultural integrations. They both seem to share the same opinion of its effect in diversifying backgrounds, in that better technology can make it easier for people to interact from opposing cultures to understand each other and converse. In the beginning, both interviewee's presented with a relaxed and optimistic attitude, which is great for producing authentic results. My first couple of questions, "Do you have active connections within the DHH community, and have regular exchanges in your day-to-day life?", and "How do you see your role in the DHH community", granted me a sense of centeredness, as both of interviewees were quiet experienced and influential within the DHH society at RIT. This was positive as the following question would enhance that level of credibility: Have any recent developments on in DFF technology impacted how you converse with your peers? Michael Berezyuk noted a recent improved video-chat based software that he engages with quite often with his friends, as well as the internet in general

bringing friends closer than ever. This one of the common ubiquitous technologies noted in my literature review. When asked about their optimism towards growth in DFF technologies? The interpreter initially was profoundly articulate and open, stating her job we be a lot easier with the help of technology, and even non-existent. But, she does worry that technology can't accurately capture and synthesize a DHH's persons full expression. This is a legitimate concern, as we've seen technology like smart gloves failing to be appropriate to the deaf needs. Next the questions "What misperceptions do the DFF exhibit most frequently?" and "Do you think technology plays a role in inhibiting this negative judgement?" Had deeply visible concerns from the interpreter, whereas not so much from Michael. The interpreter shared how technology could potentially exacerbate misunderstandings within cultures if not properly implemented, and how important user feedback is from both parties, hearing impaired and non-impaired. Her response closely ties in with a lot of the themes brought up in Misconceptions of the Deaf, as technology is intimately personal and affects each individual differently. We should be careful before a forceful implementation of integrated innovative auditory systems. On the contrary, Michael struggled to identify technology having a role to play in cultural misperceptions, stating that it would only shorten the language barrier, thus helping connect identities and discourses. Which fundamentally is at the root of these misperceptions, is being able to understand and listen to one another. The results from "What technologies are ubiquitous in the DHH community?" weren't as surprising and matched up with a lot of the common technologies noted in *Deaf Technologies* by Joan. Mostly interestingly question "What technologies do you engage with on a daily basis?" received quite a lot of responses from the interpreter, and not that many from Michael, as he currently wears a hearing aid, eliminating the "need" for a lot of other technologies. However, he did say closed-

captioning and a few other technologies like notetakers were incredibly useful in his past. The interpreter mentioned using translators, interpreter scheduling apps, a variety of iPhone utility apps for the deaf, and unsurprisingly not using video-relay when asked. Most of these technologies the interpreter tie in directly with the results shown in "Technology Use Among Adults Who Are Deaf and Hard of Hearing: A National Survey". Meaning when technology is made useful for bringing cultures together, and done so in a simple manner, it is invaluable. The rest of the questions: "How do you see the future of DHH the technologies?", "What concerns / moral dilemmas do you have regarding the digital integration of technologies with physiology and life?", and "Do you genuinely believe innovative DHH technologies hold merit and will diversify literacies and backgrounds?" Other than the slight moral dilemmas expressed by the interpreter, both interviewees have expressed a deliberate desire for the pursuit of innovate technologies, and bringing literacies together. Technology will probably inevitably unify the two distant realms of the hearing and non-hearing sometime in the future, but until then I believe we should keep pushing for the evolution of linguistics and diversification," (Interviewee 1, Michael). It was commonly noted by Michael Berezyuk, the average DHH interviewee that besides the medical benefit, there is a growing prominent market for deaf-and hard of hearing friendly UI-UX based digital applications. Also Michael mentioned bio-embedded technologies like Elon Musk's neuralink(an implantable brain wave readable machine interface) is nothing short of exciting.

Conclusion:

Overall, after exhibited results from both hearing-impaired interviewees, and with such evidence of emerging technologies showing mostly promise in the near future, the implications for a promotion of innovative technologies are minimal, and the burden of not implementing them would gradually increase. When deaf technologies are properly introduced and culturally appropriate, they will flourish. Whether or not the DHH community realises it, technology is only going one way: forward. Certain technologies must be accepted for the evolution of literacy and discourses, Innovative auditory technology is not only here to stay, but to proliferate.

References:

Michella Maiorana-Basas, Claudia M. Pagliaro, Technology Use Among Adults Who Are Deaf and Hard of Hearing: A National Survey, *The Journal of Deaf Studies and Deaf Education*, Volume 19, Issue 3, July 2014, Pages 400–410, https://doi.org/10.1093/deafed/enu005

Misconceptions of the Deaf_Giving Voice to the Voiceless (Terry, et al) Vol 9–10 (2016–2017)|ISSN 2161-6590(online)|DOI 10.5195/hcs.2017.211| http://hcs.pitt.ed

Roszkowski, Ernest, "audialText: Improving communication accessibility for the deaf through automatic voice-recognition and wearable smart-technology." (2017). Thesis. Rochester Institute of Technology. Accessed from https://scholarworks.rit.edu/theses/9696

D. K. Sarji, "HandTalk: Assistive Technology for the Deaf," in Computer, vol. 41, no. 7, pp. 84-86, July 2008.

doi: 10.1109/MC.2008.226

Allen, Sarah, et al. “Exploring the Acceptability of Innovative Technology: A Pilot Study Using LENA with Parents of Young Deaf Children in the UK.” Child Language Teaching and Therapy, vol. 33, no. 2, June 2017, pp. 117–128, doi:10.1177/0265659016671168.

Naturale, Joan. Deaf Technologies. , 2016. (Last Updated: Nov 25, 2019 3:39 PM)

"Banks face massive payouts to deaf customers". Action on Hearing Loss / RNID. February 21, 2012. Archived from the original on June 4, 2013. Retrieved April 12,

2015.

Erard, Michael. “Why Sign-Language Gloves Don't Help Deaf People.” *The Atlantic*, Atlantic Media Company, 10 Nov. 2017, www.theatlantic.com/technology/archive/2017/11/why-sign-language-gloves-dont-help-d eaf-people/545441/.