Spring 2018

# On Equal Footing? A study on how adult members of the Deaf and hard of hearing community (in the United States) perceive that the procurement, use, or absence of assistive technology has influenced their lives

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ON EQUAL FOOTING?

A STUDY ON HOW ADULT MEMBERS OF THE DEAF AND HARD OF HEAERING

COMMUNITY (IN THE UNITED STATES) PERCEIVE THAT THE PROCUREMENT, USE,

OR ABSENCE OF ASSISTIVE TECHNOLOGY HAS INFLUENCED THEIR LIVES


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A capstone paper submitted in partial fulfillment of the requirements for a Master of Arts in

Intercultural Service, Leadership, and Management

at SIT Graduate Institute, Brattleboro, Vermont, USA


May 7, 2018

Ryland White

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Student name: _____*Bradley W Anderson*_____ Date: _May 7, 2018_

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ABSTRACT

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*A study on how adult members of the Deaf and hard of hearing community (in the US) perceive that the procurement, use, or absence of assistive technology has influenced their lives*

Technology has changed each of our lives, that is certain. Findings from previous studies about assistive technology plus personal interviews and a survey were used for this interpretive phenomenological study. Interviews were conducted with people associated with the researcher's work. Existing literature regarding assistive technology produced themes revolving around systemic policies & practices, various types of assistive technology, the users of assistive technology themselves (situation, age, circumstances, etc.), and the impact of assistive technology. The last theme is the focus of this qualitative study: how adult members of the Deaf and hard of hearing community's lives have been affected by assistive technology. The devices and services mentioned by the participants are explained and/or illustrated. Comments made by the interviewees are divided into two arenas: the effects of using assistive technology and the effects of not having it. Assistive technology has helped to create a much better life for the interviewees overall, in their opinion. Each expressed that they feel a part of the larger society, can be successful at work, can know and be known, and look forward to what the future holds, albeit with some concerns. This study shows that although technology has improved their lives, equal footing for them (& others) in a hearing world may not have arrived yet.

On Equal Footing?

A study on how adult members of the Deaf and hard-of-hearing community (in the United States) perceive that the procurement, use, or absence of assistive technology has influenced their lives

**Introduction**

Prior to 1992, in my own mind, the deaf were a group of people that had the misfortune of not being able to hear.  They, as a group, were not in my consciousness, generally, as I had never had the opportunity to meet or know anyone who was a part of that community.  I was oblivious to their way of life, struggles and experience in society, which in my case was (and is) the United States.  It was not my practice at the time to be up-to-date on news other than major events, so the passage of the Americans with Disabilities Act (ADA) in 1990 does not stand out in my memory. In 1992, I became a part of a church where there were a small group of deaf parishioners, and where there were church members who interpreted the services for them using Signed English (sign language using the grammar and word order of English). Once I was settled in the church, I began to feel some discomfort in the fact that I could not communicate with these people who were sitting in my church.  After being taught by one of the interpreters, eventually I became an interpreter myself.  I started with lyrics to hymns, then progressed to spoken words, including sermons.  This led, 8 years later, to a job in a private school, under the auspices of the area education agency, where I interpreted for a Kindergarten student for an entire school year.  He had received a cochlear implant (CI) at age 2.5 years <u>(Petaros, 2013)</u> and he had some hearing capabilities. I was there as a support for him so he could understand and be a part of his all-hearing school.  When I moved away from that area the following year, I had no personal contact with any

person who was deaf until thirteen years later, in 2015.  That was the year I enrolled in my first American Sign Language (ASL) class as a student at SIT Graduate Institute.

Through my studies (including my two ASL classes) at SIT, I became aware of the concept of the "other" and of marginalized people groups that I never consciously understood were such; for example, the Deaf and hard of hearing (DHH) community.  I have no doubt that the simple act of including the intermediate skill in sign language on my résumé caught the attention of a recruiter hired by Sprint (telecommunications company) to find a temporary worker within Sprint Accessibility.  Sprint has provided relay services to those who are DHH or have speech disabilities for over twenty-five years.  These services are mandated by the U.S. government and are led by state government employees.  The Sprint Accessibility team (50+ employees, not including contractors) works directly with the state and federal governments in providing these services, free of charge, to people with disabilities (PWD) within the United States.  The majority of these employees are deaf or hard-of-hearing.  This temporary position turned into a permanent job after two months, and it became my practicum experience.  Certainly, I did not expect my six months of in-the-field learning to be at a huge for-profit corporation, working from home, and with people living with some sort of a disability.

Sprint has scored a perfect 100 on the Disability Equality Index (DEI) for three years: 2015, 2016, and again in 2017 (Business Wire, 2016; Spears, 2017).  Sprint was honored in 2016 and 2017 as one of the "DEI Best Places to Work" companies for its success in disability inclusion. New York Relay (operated by Sprint) received the Title IV Public Service Award from the NYC Mayor's Office for People with Disabilities (New York Relay Service celebrates 25 Years and receives Title IV Public Service Award for people with disabilities, 2014).  The company was also given the Quality Services for the Autism Community Change Maker Award (Sprint receives 2014

QSAC Change Maker Award for Ccmmitment to accessible mobile technology, 2014).
Leadership is key to any company-wide change such as been occurring at Sprint. Michael J. Ellis
is the Global Vice President of Accessibility and has been employed at the company for many
years. He is leading the charge to expand Sprint Accessibility's reach beyond relay services for
the deaf and hard of hearing. The goal is to provide avenues for people living with all kinds of
disabilities to communicate using technology that Sprint offers (or will offer). As a man who lost
his hearing in his early twenties, he has experienced this reality first-hand. In a testimony to the
US Senate Health, Education, Labor & Pensions Committee, he stated "The company embraces a
diverse and inclusive workforce. At Sprint, we believe diversity fosters creativity, sensitivity and
growth. Through diversity we have been able to grow our product portfolio to be more inclusive"
(Ellis, n.d.). In a time when companies (including Sprint) are employing fewer people, the Sprint
Accessibility division is growing, and the leadership team and CEO are all for it, putting the
company's resources behind the effort.

During the course of the Reflective Practice period, I wrote concerning three salient aspects
of my experiences. Those papers centered on (1) the power of language in intercultural
communication, (2) the changes in the lives of PWD since the passage of the ADA in 1990, and
(3) technology. All three topics have been a part of my experiences at Sprint, yet one stood out as
very relevant to my work: technology. Sprint is not viewed as a technology organization, but it
is technology that is the basis for all that it is. I realize how much technology has made my life
better and working at Sprint made me wonder about how the DHH community felt about it. Almost
everyone within the US is affected by technology in one way or another; it has become the "norm"
in our society. So, I desired to ask those who are DHH regarding their experiences with technology
and how it has influenced their lives, which became my research question: "*How do adult members*

*of the Deaf and hard of hearing community (in the United States) perceive that the procurement,*

*use, or absence of assistive technology has influenced their lives?"* So, I went to the literature to

learn what others have written about this topic. I then interviewed people who are DHH to learn

from their perspectives.

### Literature Review

No one doubts that technology impacts the life of every human on the planet, in one way

or another. People living with disabilities are no exception. The difference between what

technology means to PWD and to those who are temporarily-abled lies in the reason that each

person engages with, obtains, and learns about any given technology. For PWD, technology is

used to communicate, live, work, and play in a society designed for those without any disabilities.

In the temporarily-abled world, technology also helps people communicate, live, work, and play.

However, people without disabilities can decide to use technology (or not use it) and that decision

may not necessarily change their lives in relation to the rest of the world, outside of the speed and

convenience that technology affords all of us.

In searching the literature, the definition of "assistive technology" (AT) varies but

generally aligns itself in one thought. The prevailing definition says that AT is "technology

adapted or specially designed to improve the functioning of people with disabilities" (Bowser,

2013, p. 10). One report stated that "The International Standard Organization (ISO) (2011) defines

AT as 'any product, instrument, equipment or technical system used by a disabled person, specially

produced or generally available, preventing, compensating, monitoring, relieving or neutralizing

disability'" (Kylberg, et al., 2015, p. 53). An internationally-accepted version of this definition

was cited by Carver et al.: "any item, piece of equipment, or product system, whether acquired

commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve

functional capabilities of individuals with disabilities" (Carver, Ganus, Ivey, Plummer, & Eubank, 2016). This definition was first used in the US in the Technology-Related Assistance for Individuals with Disabilities Act of 1988 (Wise, 2012, p. 173). Reisinger and Ripat agree: "Assistive technology (AT) is any device, piece of equipment, software, or other tool that is used by individuals with disabilities to perform activities that might otherwise be difficult or impossible because of their disability" (2014, p. 1501). Another author believes that, yes, AT refers to the equipment used, but that AT should be a subset to the overarching realm of Universal Design (UD), specifically in the workplace:

> Assistive technology's rightful place, in an environment focused on UD, should be as a gap filler as employers move toward workplaces that work for everyone. Universal design focuses not just on physical environments but also on company processes and the accessibility of them. Assistive technology becomes, then, the focus of reasonable accommodations or personal vocational rehabilitation. (Basas, 2013, p. 73)

This aspect to the definition means that, in a perfect world where there is equity for everyone, AT is not the goal. The goal, according to this study, is that the norm would be inclusive of all and that AT would be used as a temporary stop-gap measure until a new norm could be established.

A second aspect surrounding the definition of AT was mentioned or alluded to in only one article, but it seeks to move the term away from its divisiveness. "They [assistive technologies] are no more 'assistive' than any other technology that people use to perform everyday tasks. For these technologies to achieve their full potential for end users, they must form part of a system or network that resists dissociation" (Haualand, 2014). According to this author, using the word "assistive" continues the separation of PWD from others. Shinohara & Wobbrock posit: "When a device successfully supports a user's identity functionally and socially, the device 'disappears'

into the task-at-hand" (2016, p. 5:24). In other words, there is no longer a noticeable separation when the device is appropriately designed and used. This idea that the term "assistive technology" itself could be perpetuating the divisions in society based on abilities certainly begs some consideration and more study.

Articles written on the subject of AT are numerous, and many are dedicated to the general topic of disabilities, combining more than one type of disability in the study. Others limit their culture of inquiry to those with a certain disability. Terms including "assistive technology," "assistive," "disabilities," and "technology," "impact," and "deaf" were used when searching for existing literature for this study. All types of disabilities were taken into consideration when determining the overall themes of the literature about technology in combination with disabilities.

**Systemic philosophies, policies, and practices.** Included in this theme are studies concerning governmental or organizational policies and how they manifest, processes for obtaining AT devices, individual company or organizational practices, and barriers to equal access caused by these policies and practices (or lack thereof).

One's philosophy determines actions and attitudes, whether that "one" is a person, organization, or a government. Philosophy becomes that lens that colors all else. In the study of disabilities there are a variety of these lenses, or "models," discussed in the literature. "The functional limitation, economic, and medical models all define disability by what a person is not" writes Karger & Rose (2010, p. 75). They also mention that "the psychosocial model… views disability as a socially defined category" (Ibid). Another study mentions that "theorists have identified responses to disability as reflecting either a 'medical' or a 'social' model" (Griffin, 2015, p. 86). Kylberg illustrates that these differences in philosophies often occur within one country as well as national governments:

The purpose of AT and what it included was seen differently by professionals interviewed in the two countries. In Latvia, those responsible for healthcare issues and for implementing regulations had a medically oriented view of the purpose of AT, whereas the Latvian practitioners had an understanding more similar to the one expressed by the Swedish informants: to support activity and participation. (2015, p. 60)

National governments enact laws regarding PWD, and there are various studies that identify these laws and their effects. One helpful study written just after the passage of the United States government's ADA law lists legislation passed since the founding of the country in topical sections such as Facility Construction & Architectural Design, Deinstitutionalization & Independent Living, and Civil Rights & Advocacy. (Reed, 1992). Reed states that it was the Smith-Fess Act passed in June 1920 that first allowed civilians with disabilities to receive benefits from the U. S. government (p. 399). Karger & Rose wrote that PWD were not considered a protected class until the 1988 Fair Housing Act. (2010, p. 74), two decades after the civil rights movement erupted on many fronts in the 1960s. The US' eventual passing of the ADA in 1990 was the first legislation that covered people with any form of disability.

International bodies and gatherings also have established policies with which member nations have agreed to comply. One of the first international gatherings that affected national policies on disabilities was the World Summit on the Information Society (WSIS) held in 2003-2005 and also in 2015.

WSIS is an important moment for the emergence of disability as a major issue in communication rights and social justice globally… From humble beginnings with a handful of overlooked representatives in 2002, the international disability movement had

formally organized as a group (through the Disability Caucus) and gained legitimacy and

recognition by other stakeholders, including governments. (Goggin, 2015, pp. 329, 332)

The United Nations has also been active for PWD.

In 2007, the United Nations Development Programme released the Convention on the

Rights of Persons with Disabilities (CRPD), creating an international document focused on

improving the overall health and community participation of people with disabilities by

proposing policy that advocates for their rights. The CRPD has been signed by over 150

countries. (Barlott, Adams, & Cook, 2016, p. 189).

Access to AT is reflected in numerous studies. Poverty and low income, as threats to access,

are mentioned: "…only 5–15% of people with disabilities in lower-income countries have access

to AT and that AT is usually in the form of mobility aids" (Barlott et al., 2016, p. 190).  Poverty

for PWD can become a vicious cycle: "Having and using the right AT device may mean the

difference between being locked in poverty and having the opportunity to work and earn a living"

(Stumbo, Martin, & Hedrick, 2009, p. 103).  Barlott and colleagues concur when they note that

"poverty can be viewed as both a cause and a consequence of disability" (p. 189).

Barriers were often discussed in the literature, sometimes in regards to technology. Okolo

& Diedrich asked educators in the state of Michigan about the use of technology in the education

of students with disabilities. Seventy percent of these educators themselves said that staff

knowledge (meaning the lack of knowledge) was a barrier to students using AT (2014, p. 12).

Barriers in the use of AT for dementia patients were delineated by Gibson et al.  They found that

"both the direct and indirect costs of AT were repeatedly highlighted as a potential barrier to their

use" (Gibson, Dickinson, Brittain, & Robinson, 2015, p. 8). Physical barriers were also discussed

in studies about architectural design (Sherman & Sherman, 2012) and transportation, building and city design (Naami, 2014). Many times, though, studies showed that barriers were caused by policies or procedures of various entities or even by the advancement of technology itself.

> In many ways, both the growing pace and the amplitude of this [societal and technological] change has led to a widening of the gap between members of society who adapt and those who have difficulties adapting. Citizens aged 65 or over - the elderly - suffer from the added limitations that come with the aging process. (Saracchini, Catalina, & Bordoni, 2015, p. 66)

Studies involving people groups such as the Navajo Nation in the Southwestern US (Reisinger & Ripat, 2014), designers and architects (Basas, 2013), or employers within the US (Donohue III, Stein, Griffin, & Becker, 2011; Griffin, 2015; Smith & Andrews, 2015) all illustrated policies or practices that created barriers to PWD.

**Types of AT (historical, current & future) and their uses.** Technology is certainly used in some way by all people regardless of their abilities: "the phonograph was initially developed to support talking books, improving education and information access for people with disabilities; this was also the case with the development of the cassette tape a number of years later" (Barlott et al., 2016, p. 190). This study also stated that the telephone was developed for the hearing world and that it further marginalized those in the Deaf community. Yet, when people realized digital data could be transmitted over phone lines, soon came the invention of the TTY, which served as the precursor to what we now know as text messaging (Ibid). AT use during exercise is promoted and encouraged as a way to overcome mobility obstacles: "As PWD continue to face limited options for exercise and leisure physical activity, adapting new and emerging technologies can provide multiple innovative approaches to addressing the major research and development issues

in this understudied population" (Rimmer, Lai, & Young, 2016, p. S250). Mobility AT is the subject of a report about its impact on the participation of PWD (Carver et al., 2016). Elmannai and Elleithy's work reported that there are three categories of visual AT designed for use by "visually-impaired" people: vision enhancement, vision substitution, and vision replacement. Their study focused on vision substitution technology that uses sensors (2017, p. 2). Technology designed to assist people with blindness as well as those with multiple disabilities to navigate inside their homes was the subject of a report which stated that "Orientation and travel problems within indoor daily contexts may be quite frequent among persons with profound intellectual disability or combinations of blindness and intellectual disability" (Lancioni et al., 2014, p. 198). A 2015 survey of empirical studies had the goal "to identify and synthesize measures for accessibility to electronic communication for people with cognitive disabilities…" (Borg, Lantz, & Gulliksen, 2015, p. 547). The authors found a number of studies that included data on the use of various kinds of AT.

Wireless Body Area Networks (WBANs) and their increasing use were the subject of a report about technology of the future "as an important part of the daily life for ambient assistive living" (Alam & Hamida, 2014, p. 9153). Mobile AT was reported to be the way of the future: "The proliferation and advantages of mobile, connected devices have the potential to support the global application of AT based on smartphones and tablets" (Barlott et al., 2016, p. 191). The "Internet of Things" is becoming reality as more and more devices can be controlled via wireless connections. A report from 2012 gave practical scenarios with diagrams of how that could possibly be realized by PWD in three different arenas: while shopping in retail stores, during a student's school day, and at home (Domingo, 2012).

Most types of AT for the DHH community were included in studies about technology usage among PWD in general. "Hearing loss is sometimes known as the invisible disability" wrote Schaffer in a work promoting compliance to the listening requirements of the Americans with Disabilities Act (2014, p. 132). None was more prevalent, though, than the cochlear implant (Miller, 2015; Archbold & Mayer, 2012; Denham & Battro, 2012) and its usage by students who are DHH. "…[A] convincing case can be made that no other recent technological innovation has had as large of an impact as the introduction of the cochlear implant (CI), especially for children who are deaf or hard-of-hearing" wrote Miller (p. 6). Hearing aids and assistive listening devices (ALD) have also been studied (Rekkedal, 2012; Aberdeen & Fereiro, 2014). Rekkedal writes: "Individuals with HA [hearing aids] are evaluated more negatively by teachers, parents, and hearing peers on dimensions such as intelligence, achievement, and personality through a phenomenon known as 'the hearing aid effect,' which has been confirmed by a number of research studies" (p. 500).

There were many reports that discussed the kinds of AT available and how they are being used. Some included details on mobile applications ("apps") that were current at the time of writing. Because technology changes often, these types of studies are not as useful as one would like. For example, a 2007 study of Australian teens' use of electronic communication reported that "the major change asked for was a video capacity" (Power, Power, & Horstmanshof, p. 86).

**AT users and their perceptions**. There are not only many types of AT but there are also many types of AT users. A person's stage in life, their environment, and sometimes their physical location all play a part in their perceptions. This is the reason these two aspects are combined in this theme: the situation of the person, and perceptions that are based on their own life.

Much of the literature is focused on the education of students living with disabilities. Age ranges in these reports were varied, from college students to preschool. How university students were impacted by AT services was the topic of a report that stated "The outcomes of assistive technology (AT) support services for post-secondary education students with disabilities are under-reported, and little is known about use-profiles and user experiences when AT interventions are applied to this rapidly growing population" (Malcomb & Roll, 2016, p. 1). At the other end of the age spectrum, referring to early childhood, Miller writes: "The positive impact of each type of technology [CI, newborn infant hearing screening, telepractice] on students who are deaf or hard-of-hearing is described with an emphasis on the development of speech, language, and hearing skills" (Miller K., 2015, p. 5). One report was the result of a survey of school teachers on their own AT use and knowledge as well as their perceptions about their students' use (Okolo & Diedrich, 2014). Belson & Hartman wrote that their purpose was "to describe a pilot study that investigated the use of digital pens in combination with the Cornell note-taking system with high school students with learning disabilities." (Belson, Hartmann, & Sherman, 2013, p. 13). Another wrote how CI technology has changed deaf education:

> It has changed educational choices for parents and led to improved levels of spoken language and educational attainments. However, cochlear implantation has served to make an already diverse group, even more heterogeneous, increasing demands on teachers of the deaf, and continuing to make educational choices for their children a major issue for parents. (Archbold & Mayer, 2012, p. 12)

And many others focused on how AT has affected the entire student population (Shepherd & Alpert, 2015; Wilson, 2011; Rekkedal, 2012; Denham & Battro, 2012; Zirzow, 2015)

A small amount of existing literature examines specifically the perceptions of PWD in relation to AT. One study is very pointed in its data gathered from parents of deaf children: It "examines perceptions among parents of deaf children with additional disabilities regarding satisfaction with service provision, benefits, and challenges of the CI process." (Zaidman-Zait, Curle, Jamieson, Chia, & Kozak, 2015, p. 41). Another report indicated how residents of the Navajo Nation view the process of their nation's ability or inability to provide adequate AT. One of the respondents stated, "… a lot of them want to go voting but they don't have that access-to vote or to go be a part of the chapter meetings." (Reisinger & Ripat, 2014, p. 1505). Another study dealt directly with the act of AT use and how those that they studied believed it made it them feel in certain social situations: "Our goal was to explore the types of interactions and perceptions that arise around AT use in social and public spaces" (Shinohara & Wobbrock, 2016, p. 5.1). This same report made a very interesting and thought-provoking statement: "Our study participants' experiences largely centered around the notion of how technology may or may not be an extension of the identity we want others to see." (p. 5.29). What may be considered by the able-bodied individual as a cut-and-dried decision (whether or not to use AT), those that actually are in a position to use it may not feel as if they want to do so. The elderly were the subjects of a few studies, including one that studied the perceptions of aged Australian citizens in relation to ALD use (Aberdeen & Fereiro, 2014). McCaig et al. used a qualitative approach in their study concerning the impact of AT use on the lives of the elderly. Through their work they found six themes in the experiences of older people who use AT: (1) being unsure, (2) being old; (3) being a bother, (4) being on [their] own; (5) being neighborly, and (6) being independent (McCaig, Waugh, Duffy, & Martin, 2012, p. 171). And the elderly were also Saracchini's focus in a report

about a relatively new mobile technology called augmented reality (2015). PWD come in every age and live in a variety of circumstances, and that is evident in the literature.

**Impact of AT on the users.** Stumbo and her colleagues evaluated one group's research and wrote: "One of their most interesting findings was that unemployed individuals did not see the lack of AT devices as a barrier to work, while employed individuals, who had considerably greater education, viewed AT as one of their most valued assets – perhaps indicating that unemployed individuals were unfamiliar with technologies that might enable them to work" (p. 104). Depending on the individual, then, the impact of AT is somewhat fluid. This is illustrated by a study that "note[d] that the intent of AT is to enhance function and improve the independence of the user; yet, these same devices, if perceived negatively by the user, actually have the reverse effect" (Carver et al., 2016, p. 2).

Certainly, an entire society can be affected by large-scale technological "advancements," as shown in the following quote:

> …a changing technological environment can dramatically alter the functional impact of any given disability. For example, the development of the telephone greatly enhanced communication in general society. At the same time, the central importance of aural communication in a telephone-dominated society made deafness an increasingly debilitating disability. Similarly, the emergence of a computer-dominated society and its text-based reliance on e-mail and cell phone texting has placed new burdens on the blind." (Wise, 2012, p. 171).

Most of the articles and studies found for this report that had "impact" (or something similar) as a part of their content provided examples of how a person, or group of persons, had

been affected by AT. There were a few that also mentioned the impact to people who did not have assistive technology at their disposal. "Limited access to services and difficulties communicating can be very isolating and frustrating. And they are highly individual; no two persons have exactly the same patterns of hearing loss" wrote Schaeffer (2014, p. 132) in regard to the DHH population. In Basas' study, she said, "Failures in technology and accommodation result in missed communication, lack of inclusion in decision-making processes, reduced productivity, and increased stress and absenteeism" (Basas, 2013, p. 78).

By far, however, the research showing the impact of AT was mostly just that: how the user has been affected by having it in their life. Online searches (using the SIT Library website and Google Scholar) for studies on the subject of assistive technology netted approximately sixty-seven different peer reviewed reports. Most of this published research spanned 2010 or later. Of those sixty-seven, fifty-four (81%) had content regarding the impact of AT on the lives of the users (including those people around them). Twenty-four (44%) of those fifty-four articles reported on the DHH community specifically. Narrowing the focus even further, from those twenty-four DHH-centered reports, twelve of them (50%) discussed students (including college students) and/or children. In these twelve studies, the topic of educational AT use, specifically cochlear implants and hearing aids, was prevalent. Seven (29%) of the twenty-four DHH studies wrote concerning adults, four (17%) did not specify any certain age range, and one (4%) included all ages in its findings. There were only two articles out of the twenty-four (8%) that had an even greater degree of discussion about the impact of AT on the lives of adults in the DHH community. Both of these told the experiences of the Australian DHH community. One of these focused on the elderly (Aberdeen & Fereiro, 2014) and the other, while it quantitatively delineates the usage of AT, includes much about AT's effect on lives (Power, Power, & Horstmanshof, 2007).

The lack of research in any given area within the field of AT was bemoaned in numerous studies, regardless of the topic the author(s) desired to research. 1 ) "There is a paucity of literature regarding the way in which AT devices affect the consumer" (Carver et al., 2016, p. 1); 2) "A review of care delivery approaches to promote seniors' independence reported that little research evidence exists to support or refute the claim that AT use decreases dependence on caregivers…" (Mortenson, Demers, Fuhrer, & Lenker, 2012, p. 985); 3) "There has been limited research to date exploring how people with dementia and their families use technology in their daily lives" (Gibson et al., 2015, p. 2).

Thus, the four themes in existing literature highlighted in this review are: (**1) systemic philosophies, policies and practices**; (**2) types of AT (historical, current & future) and their uses; (3)   the situations of AT users and their perceptions**; and (**4) the impact of AT on the users' lives**.   These themes are in decreasing order based on the amount of literature found, with reports discussing systemic issues the largest, and the theme of the impact of AT, the least.  Of course, this is very subjective and is only a perception based on current circumstances and findings. However, the amount of qualitative research published regarding the affects that assistive technology has had on the lives of adults in the Deaf & hard of hearing community is, indeed, very sparse. The current study seeks to add to the literature by not only sharing what others have found plus what was learned through a small number of interviews with adult members of the United States' DHH community.

## Research/Practitioner Inquiry Design

The research methodology used for this study is the phenomenological (interpretive) approach. The subjective experiences of the interviewees as well as information from existing literature were categorized and organized to form an overall picture of how the use of AT has impacted the lives of those who are deaf and hard of hearing.

An unexpectedly small number of interviews were conducted with co-workers of the researcher. Six adult members of the DHH community at Sprint were interviewed over the course of two months, when time permitted. Five of the interviews were interpreted by certified ASL interpreters who were known by both the researcher and the interviewees. There were no face-to-face interviews, so videoconferencing software was used and all could see each other clearly. The other interview was conducted using only a phone since the interviewee had hearing capability; it was at the interviewee's suggestion that an interpreter not be present. There were three other persons contacted about participating but they chose not to do so. A seventeen-question pre-interview online survey was answered by five of the interviewees. One person did not complete the survey, and due to timing, the researcher asked the survey questions of another interviewee during the interview.

Because of the small number of interviews scheduled, the researcher submitted a revised proposal to the Institutional Review Board. The Board approved the plan to combine the pre-interview survey and interview questions into one online, anonymous survey, in hopes that others, outside of Sprint, would want to participate. After contacting three outside DHH organizations, with no response or no participants, the researcher determined that the six interviews would stand alone, and that any applicable data from existing literature could be added.

A majority of those interviewed for this project did not give permission to be visually and aurally recorded, so none of the interviews themselves were recorded. While the comments made by the interviewees were voiced by the interpreter, the researcher wrote notes (which is a privilege afforded to a hearing, sighted person). These handwritten notes were immediately typed and comments were ultimately coded by topic. These topics were then condensed or organized into overall themes.

The limitations of this study include the fact that it is not "scientific," i.e. there was no controlled group. Secondly, all of the participants know the researcher as a co-worker; it was not an anonymous process. A third limitation is that 83% of the interviewees are homogenous in their race, have only a nineteen-year maximum age difference (ages 40-59), and their perceived socioeconomic status is similar. The gender ratio for this study was 50% male, 50% female. Because of these factors, and because they all work for Sprint Accessibility and use the same kinds of technology at work, the responses to questions about technology are most likely not representative of the United States' DHH community as a whole. Enhancements to the study will be presented in the Future Research section of this work**.**

**Findings**

Each interview lasted approximately 45-60 minutes at a time when all three participants (researcher, interviewee, interpreter) were available and free from other distractions. Data contributing to the findings came from both the interview and the pre-interview survey.

Each participant was asked to share their current and past AT usage. This was subjective and relied on each person's memory at that particular moment. When boiled down to commonalities, there were six areas that emerged: captioning, relay/interpreting/captioning

services, a video device or app, hearing aids, texting, and other sensory notifications.  Table 1

shows the number of times each of these areas was mentioned.  Captioning leads the list with

twelve references.  Included in this area are the teletypewriter (TTY/TDD), captioning and caption

box for movies and television, and captioned telephone.  Various services are listed next.  These

included VRS (Video Relay Service), CART (Communication Access Realtime Translation),

CAN (Computer Assisted Notetaking), RCC (Relay or Remote Conference Captioning), TRS

(Telecommunication Relay Service), and VRI (Video Remote Interpreting). The third category,

video device or app, refers to a videophone or an app such as FaceTime.  Hearing aids, followed

by texting devices and finally, other sensory notification devices such as vibrating alarms and

flashing lights rounded out the list.



Table 1 - Kinds of AT Used (Past and Present)
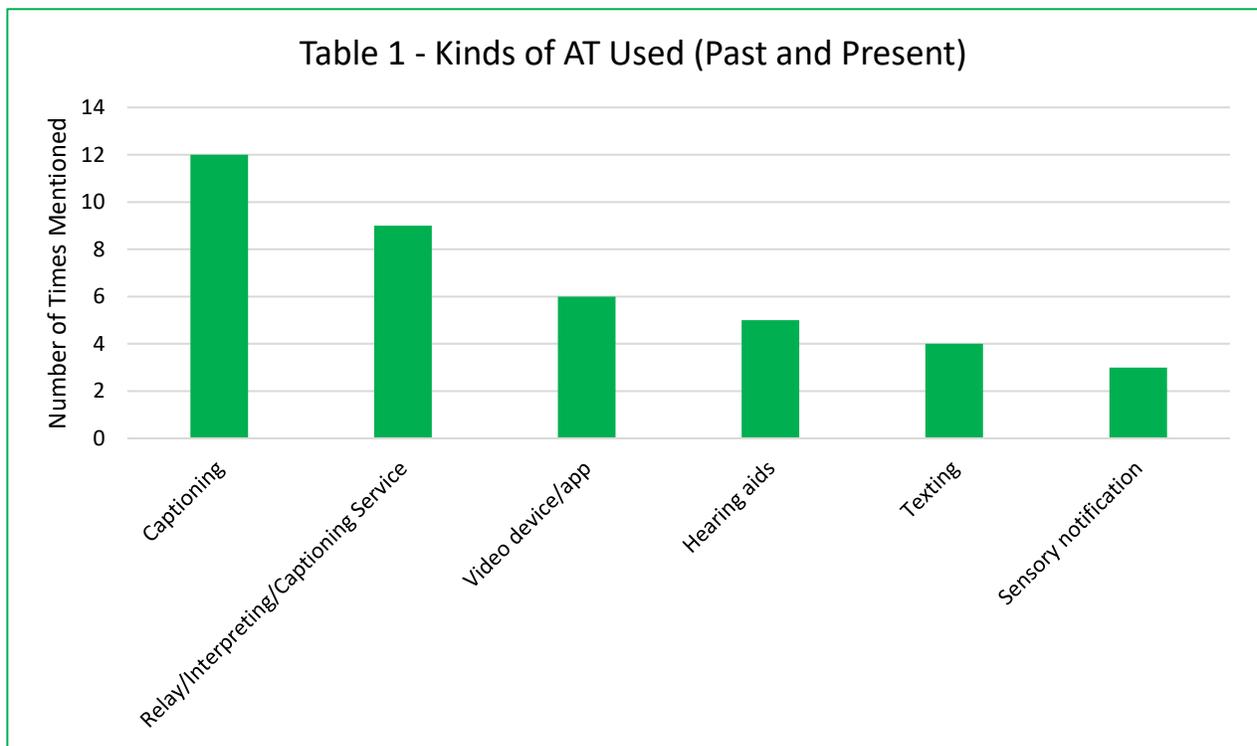
**Devices and Services Referenced During Interviews**

**Teletypewriter/Telecommunications Device for the Deaf (TTY/TDD).**  These devices

began as military equipment, but were refurbished for use for personal communication by the

deaf when it was discovered that a phone line could transmit signals via a modem in 1964 (Telecommunications device for the deaf, n.d.). Users type on the keyboard which then transmits those words to a receiving device.



Illustration 1: old teletype machine



Illustration 2: Navy women typing on TTY



Illustration 3: newer TTY

**Captioning box.** These were the earliest devices that captioned programming on television. They were separate from the TV itself.



Illustration 4: Captioning box for television, 1980

**Captioned telephone.** This is a telephone with a built-in display for users who have a degree of hearing but also require the written text.



Illustration 5: CapTel ® captioned telephone

**Video Relay Service (VRS).** VRS provides face-to-face communication between one who is DHH, a Communication Assistant, and a hearing individual, or, of course, between two DHH persons. This is not a US federally mandated service.

Illustration 6: VRS graphic

**Communications Access Realtime Translation (CART).**  This service provides live written English transcription of speeches, meetings, or events.  The transcript is usually projected for the benefit of participants and attendees.



Illustration 7: CART in progress during a live meeting
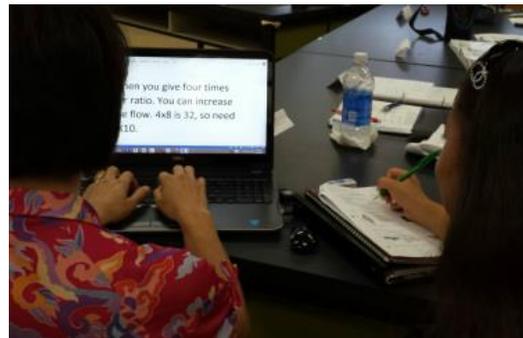


Illustration 8: Note taker using computer to assist another

**Computer Assisted Notetaking (CAN).**  A person using a computer writes notes for a DHH individual, either in person or remotely via a small local area computer network.

**Relay/Remote Conference Captioning (RCC).**  RCC is essentially the same as CART, in that both are live transcriptions, although with RCC the captioner is not physically present.  This is generally used for video conferences with the use of an audio bridge, or a telephone conference call only.  The user will see the captions for the entire call and can obtain a printed copy at its conclusion.

**Telecommunications Relay Service (TRS).** This is the name given to the umbrella of communication services to those with disabilities which were mandated by the U. S. government when the ADA became law. These services are explained on the FCC's website, www.fcc.gov/consumers/guides/telecommunications-relay-service-trs and they include: (1) "traditional" TRS for TTY users calling hearing individuals; (2) Voice Carry Over (VCO) for DHH users who wish to use their voice [See Illustration 9]; (3) Speech-to-speech relay for hearing individuals with a speech disability; (4) Non-English TRS services; 5) Captioned Telephone Service (CTS) [See Illustration 10]; (6) Internet Protocol (IP) Relay Service and IP Captioned Telephone Service, which are different from the traditional services only in the fact that the
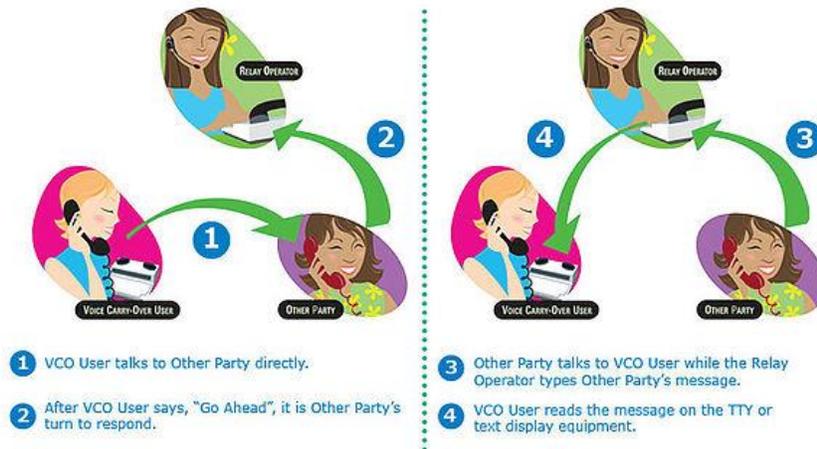


Illustration 9: Relay Hawaii VCO graphic



Illustration 10: Captioned telephone service

user/caller uses the internet to connect to the CA instead of telephone line; and (7) Video Relay Service (see above).

**Video Remote Interpreting Service (VRI).** This service, while not mandated, is used often when the DHH person and another person are in the same space but have no live interpreter present. A provider can be called who will then remotely interpret for the conversation as if they were in the room.

**Videophone.** This is the name given to some of the early devices that used video and aural communication at the same time.

Illustration 12: 1990s AT&T



Illustration 11: 1970s Bell System "Picturephone"
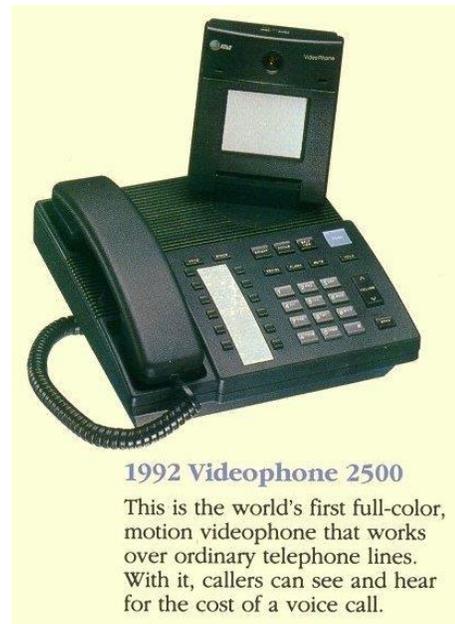


1992 Videophone 2500

This is the world's first full-color, motion videophone that works over ordinary telephone lines. With it, callers can see and hear for the cost of a voice call.

**Effects of Using Assistive Technology**

Technology, like life, is ever-changing. It has brought the citizens of the world closer together than ever before, with both positive and negative results. It is difficult to say which inventions or discoveries have played the more important roles in the evolution of technology over thousands of years. Was it the discovery of static electricity in 600 BCE, the creating of the binary

number system now used in computers (1703), or was it the invention of the electric telegraph in the 1830s? (Woodford, 2017). PWD are included in this same expansion of human contact and interaction…to a degree. Are members of the DHH community on "equal footing" with those that are not living with disabilities? This study seeks an answer, one way or another, to that question.

"**We are included.**" A comment given by the participants often was that, with assistive technology in their lives, they feel included in society. The idea came across very clearly in almost every interview. Interviewee #1 stated that he/she feels good to be able to go to a coffee shop and read or work. People wave, and he/she smiles and carries on just like anyone else would: "It makes me feel good that I have access; I am like everyone else." In responding to how he/she would define AT, he/she stated that it allows everyone to be included in society in everyday activities. In another answer Interviewee #1 mentioned that having access to relay services, the internet, texting, TTY all contribute his/her perspective that "I don't feel that I am disabled," and "I felt a part of things." Interviewee #3, believes that a purpose of AT is so that PWD can "engage in everyday activities in the mainstream with able-bodied people." Interviewee #2 simply said that "I felt equal" after AT devices like TTY and the videophone were obtained.

Communication has not always been considered a "right." A 1969 statement by Jean D'Arcy illustrates this fact: "The time will come when the Universal Declaration of Human Rights will have to encompass a more extensive right than the right to information … This is the right of men to communicate" (as cited in Goggin, 2015, p. 333). Being able to communicate with others has been an important factor for PWD to feel included, and the use of AT is credited. Interviewee #5 said that because of technology, family and friends are connected better than they previously were, without the technology. She/He said "I learn things about my family now, even though those things happened long ago; I was never aware of them…. There is more understanding."

Interviewee #6 mentioned that, while the entire family is deaf except for one niece (who uses sign language), she/he still uses texting and video chatting to communicate with family members. Interviewee #2 communicates with his/her mother using texting and VRS at times; "Mom knows basic ASL and some home-made signs." Interviewee #2's experience in college included some (not all) classes using CART technology. After each class, he/she would pick up printed copies of the transcript in order to keep abreast of the discussions and assignments.

"**We can contribute.**" Most humans want to be able to contribute something to a family, relationship, a cause, a job, or, as mentioned above, a conversation with others. In a fascinating story about the use of AT, Interviewee #1 told of her/his experience on September 11, 2001. On a flight that day, her/his plane was forced to land in Chicago. No one knew what was going on, of course, but after the plane landed, Interviewee #1's manager at Sprint sent a note over a pager asking if all was okay and proceeded to inform her/him of the events of that morning. Interviewee #1 promptly showed the words on the device to the person in the next seat as well as to a flight attendant, who shared it with the pilot. They subsequently asked her/him from whom that information had been received. None of the flight crew, at that point, knew the reason for the sudden order to land.

In the United States, the majority of adults spend a lot of time at work, wherever that might be. According to one website, 85.8% of men and 66.5% of women in the US work more than forty hours per week (Miller G. E., 2017). Yet, Basas writes that "people with disabilities are the largest unemployment minority population in the US" (2013, p. 72). With so many PWD not working, it stands to reason that those who are working want to make a solid contribution. Interviewee #4 said that AT "has helped with interaction and to express myself" at work. Interviewee #6 said that she/he used AOL a lot at one job, and that now, using software that allows "25+ people in a [virtual

meeting] room is wonderful!" Technology, whether automatically in place, or given as a request for reasonable accommodation, has helped to give PWD the opportunity to offer their complete selves to their work. Three of the interviewees (numbers 3, 5, and 6) stated that for their entire working careers, AT has always been available or that they have always been provided what they needed at work. A study that discussed how AT can help PWD stay up-to-date and active in civic and governmental affairs stated that "Technology facilitates independence and gives people a voice" (Harris, Owen, & DeRuiter, 2012, p. 80). John Moore is the president of Sprint's employee resource group called "REAL DEAL," which is for PWD and their allies. Moore stated that "We [Sprint] believe persons with disabilities can be outstanding contributors to the overall Sprint objectives and be members of everyday society – as disabled people can often times be isolated" (as cited by Spears, 2017). Sherman & Sherman remind us that the ability to contribute has not always been given to PWD: "Commonly held beliefs that those with disabilities… represent a drain on society contributed to the long-time segregation and isolation of people with disabilities. Seen as burdens to society, in years past individuals with severe disabilities were often institutionalized" (2012, p. 54).

"**We can grow and be happy.**" The founder of the American School for the Deaf (ASD), currently located in West Hartford, Connecticut, met young Alice Cogswell and her family in 1814. Rev. Thomas H. Gallaudet, a Yale master's graduate and also a graduate of Andover Theological Seminary by age 25, met nine-year-old Alice, who was deaf. He wanted to teach her, and others like her. History has shown us that for centuries, PWD were treated as outcasts. "Commonly held beliefs that those with disabilities… are less capable than others" (Cantos as cited by Sherman & Sherman, p. 54). Gallaudet believed and proved otherwise. In a sermon preached at "the Brick Church" in Hartford, five days after the opening of ASD (originally called

"The Connecticut Asylum for the Education and Instruction of Deaf and Dumb Persons"), he stated:

> …there are chains more galling than those of the dungeon— the immortal mind preying upon itself, and so imprisoned as not to be able to unfold its intellectual and moral powers, and to attain to the comprehension and enjoyment of those objects, which the Creator has designed as the sources of its highest expectations and hope (Gallaudet, 1817, p. 8)

What exists today as residential schools for the deaf are the direct descendants of the American School for the Deaf. According to Wikipedia, there are currently 50 residential schools in forty-two states and the District of Columbia (List of schools for the deaf, n.d.). These schools, as well as universities and colleges such as Gallaudet University and the National Technical Institute for the Deaf (at Rochester Institute of Technology), have indeed given the DHH community the opportunity (as Rev. Gallaudet desired) to learn skills, develop talents, and increase knowledge.

Assistive technology has played a part in providing opportunities for our interviewees to grow and learn and enjoy life to the fullest. Interviewee #3 stated that because of technology's assistance, he/she grew in self-esteem and it added joy to his/her life. Interviewee #5 said that the captioning box that provided captioning for some television shows "opened doors for me; I understood that there were more opportunities out there; and there was so much more to learn." Interviewee #6's family received three captioning boxes for their television sets, each in a different room. Interviewee #6 said, "The programming with captions was limited. We'd watch *Three's Company*, and we finally understood what a 'soap opera' was by watching *Dynasty*." Interviewee #5 added that the first program he/she watched with captioning was *M\*A\*S\*H*. "Once I could read the captions, I began to understand. I was amazed that I could understand what was happening on the show." Interviewee #2 agreed that getting the captioning decoder was very exciting.

The first experiences with AT in the lives of these six were filled with excitement and happiness, as indicated with the captioning box. The teletypewriter (TTY) also brought joy to their lives. Interviewee #4 was very excited and when she/he used it for the first time, "had to call my best friend. My parents were upset I was on it so long. I told them, 'You were on [the phone] a long time, now it's my turn.'" Interviewee #1 said their family called the TTY "The Green Monster" because it was so big; and it was placed in the basement of their home. This invention, although old-fashioned by today's standards, ultimately was a stepping stone to something else: "The technology that made this visual telephone possible led to the development of SMS (texting) on mobile phones" (Barlott et al, p. 191).

Interviewee #5: "I am ok. I have access. I am content. My life doesn't make me want to hear."

**"We have hopes."** Since AT (under the umbrella of all technology) is constantly changing and none of us know for sure what the future holds, it is a certainty that this industry will be different in ten years than it is currently. So, the six interviewees shared what they believe are some gaps in AT that would be helpful, or an up-and-coming technology that interests them. Three of them mentioned a mobile app that would instantaneously translate from ASL to spoken language and vice versa. This was the only item that was listed multiple times. If it was a reality, this technology would facilitate the ability to have in-depth conversations instead of surface topics, which is on the "wish list" of one of the participants. According to Belt,

> It is possible that the small phones we carry will soon enable us to talk to others across linguistic and cultural barriers. As smartphones become more advanced, they could obtain *Kinect*-like technology that enables signers and non-signers to communicate in their favorite language (Belt, 2014).

Interviewee #3 shared that Bluetooth-enabled hearing aids that are better for voice phones and music would be great for those with some hearing ability. Partnered with that would be improved microphones for group settings, possibly that could be broadcast directly to assistive listening devices such as hearing aids. Self-driving cars that are not activated or controlled by the voice was suggested as well. The desire to have everyone use VRS or CART services as the "norm" was also expressed.

"The challenge to society is recognizing that AT is of primary significance in affording Americans with disabilities the highest degree of independence possible, in attaining higher education degrees, successful careers, and fruitful lives" (Stumbo et al., 2009, p. 108). The interviews indicated that this is, indeed, reality.

**Effects of Not Having Assistive Technology**

**"We are not good enough and we feel it."** When the correct AT is not available or it is not provided, there are consequences. One such consequence is the feeling, by the user, that he/she is not good enough to be included or that they are not cared for. Interviewee #4 stated during the interview that when there were family events, he/she always wished for an interpreter. Interviewee #1 offered that group discussions are always a challenge because of the feeling of being left out. When attending events or meetings in the neighborhood, or schools, Interviewee #5 shared that there were usually no visual aids and so texting would be the only way to communicate with the hearing people. "I would be sitting right next to another parent and we'd be texting… but I still miss out on things."

Many of the interviewees reported that if there was no AT, they would remain dependent on others. Interviewee #4 shared that before TTY came along, communication with the hearing

population was "time consuming… my [hearing] parents would have to relay messages for me. I'd have to tell my mom *everything*!" If things were like that again now, without AT, Interviewee #4 shared that he/she would have to rely, again, on parents. One of Interviewee #5's responsibilities as a child would be to go neighbors' houses with notes from the family. The notes contained information about telephone calls that Interviewee #5's family needed to be made. So, Interviewee #5 would take the notes and then wait until all of the calls were completed. To his/her delight, though, one neighbor had a bowl of candy on the table and while waiting, he/she was allowed to enjoy it. Interviewee #2 grew up in a hearing family, and his/her father has refused to learn sign language, nor does he use VRS. Interviewee #2 said he is still in denial about having a child that is deaf, so Interviewee #2 communicates with him via a sibling that is hearing.

What follows are some of the comments made when asked how their lives would be different without AT: (1) I would be home all of the time, (2) Would have to read newspapers and books, (3) Isolated, (4) Still live with my parents, (5) No communication, (6) Left out, (7) You wouldn't know me; we wouldn't be here, (8) It'd be like a house in Maine with no phone or internet, (9) I'd still be in [another state] catching alligators, (10) despondent, (11) close to suicidal.

**"We must fight to get what you have."** The time spent by the DHH community trying to communicate with others prior to TTY or to relay services was large. The mental effort it takes to try to understand a conversation via lip reading is exhausting, no doubt. But these were (and are still) required of the interviewees in order to simply be involved in events and people around them.

Interviewee #4 shared that while in graduate school, there were CART and interpreting services available, but that both were not allowed at the same time. Interviewee #4 said, "I had to make the effort to talk to the teacher, to explain that I needed both. I became an advocate for myself." According to Interviewee #4, the teacher did not understand that an interpreter couldn't

continue for three hours at a time, but needed breaks, so CART was also necessary. Both Interviewee #4 and Interviewee #5 mentioned that it is usually a budget issue that keeps them from obtaining what they have needed. When asking for accommodations, it is still a "hit and miss" situation. "Many times we just don't want to bother with it because it is a hassle. So we find a way around it," stated Interviewee #5 adding that "Often they [organizations or companies] assume it is my responsibility." Interviewee #6 concurs, "Often I get pushback from organizations due to 'undue hardship" for them to provide accommodation." Interviewee #6 received a certification from an organization headquartered in Canada. Because the ADA is not binding on foreign companies, Interviewee #6 had to pay for the program, the interpreter, and what was needed for accommodations in order to get the certification. Interviewee #1 said that at one job she/he had, there was no TTY, no email, and no interpreter. Eventually the employer obtained a couple of interpreters, and a TTY machine. However, because there were security limitations, the TTY had to be monitored at all times, which meant Interviewee #1 had no privacy when using it.

When there is technology available, sometimes it is not sufficient. Both Interviewee #1 and Interviewee #5 mentioned that often in medical offices or hospitals, there may be Wi-Fi access, but there is not enough bandwidth or signal strength to support VRI services. Even with the ADA in force for over twenty-five years, this is still a struggle for PWD who have to constantly push for what is legally and morally their right.

**Final Comments on Assistive Technology**

While their lives are good, some of the interviewees shared some concerns that they have about the future. One concern mentioned is that since almost every device is now dependent on the internet, there should be something in place in case the web goes down. Secondly, there is a

fear of voice-activated devices becoming the "norm" in the future, which would again place the DHH community on the "outside."

Written below are comments made by the participants regarding various aspects of their lives with AT:

"I didn't like [analog hearing aids], but my family was excited. They would yell at me to see if I could hear them."

"It would be difficult for me to go to a job that was mostly hearing." [in context, this participant was referring to requesting accommodations.]

"I use [the iPad/Tablet] a LOT."

"[The mobile phone] is a blessing."

"[Hearing aids were] not satisfying because there were so many sounds. Hearing people can filter out the sounds, but deaf people can't."

"Technology is missing little pieces; diversity [is not included] when developing technology."

"A lot of people are talking about getting CI now. It's not for me."

"I've never had much use for [assistive] technology because my whole family is deaf."

## Discussion

**Conclusions.** Assistive technology has definitely affected the lives of each of the six people interviewed for this study, and there was no problem in obtaining what they have needed. The changes effected by the presence of devices over the course of their lifetimes have been

substantial, and they seem to be, based on their own words and attitudes during the interviews, changes for the better.  The excitement that they described upon receiving and using a new, helpful technology was palpable, even in their retelling of the event(s).   When comparing what was said about the effects of the technology in their lives with the effects when it was (or could be) absent, these six believe that having the AT has made a very positive improvement. Technology has helped to open their understanding to what they might have not known otherwise (i.e. television shows). It has created opportunities to know and be known by others, including their own families (personal communication).  They have been able to be successful in work, both with the hearing and the DHH communities (accommodations and video software).  Living independently and all that comes with that privilege is a reality for each of them, whereas that has not always been the case in the past. This is in congruence with a statement from a 2014 study of technology use by adults in the DHH community: "…the primary use of these technologies was to enhance sociability, followed by use in business and/or work settings" (Maiorana-Basas, 2014, p. 3). These uses of technology have given them chances to contribute and be a part of a society that once, as a group, hid and shunned them.

Wayne Betts, Jr., a deaf man who founded the company that provides VRS to San Francisco's deaf-owned pizzeria called "Mozzeria" commented, "With video relay service, I feel that I am on equal footing" (Simon, 2016). In this same vein, a report which discussed technology for those that are deafblind stated: "So the communication barriers for people who are deafblind are many, and they're difficult challenges to deal with. But thanks to technology, we've come a long way to leveling that playing field" (Berrier, n.d.). A similar study in the DHH community reported that "It [mobile technology] levels the playing field by lowering the barrier of

participation and allows them to maintain their friendships in ways that are convenient and simple"
(Henderson-Summet, Grinter, Carroll, & Starner, 2007, p. 351).

However, is this community "on equal footing" with the majority of the US residents that
do not live with a disability?  Based on the data here, because of a shift in society's views regarding
PWD and technology, the American DHH community's "footing" has improved a great deal, and
that is significant. But there is room for improvement.  The entertainment industry (captioning
devices in movie theaters for all movies; better live music technology for those with some hearing)
is lacking in its accessibility.  A 2016 article about the neglect that prison systems show to PWD
and their disregard of the ADA indicates that human rights have not yet been granted
(Eichelberger, 2016).  Doctor's offices could be more accessible by having higher quality internet
connections for those who need to use AT while visiting.  Technology changes so quickly and
since so many PWD are unemployed it makes it almost impossible for many to stay up-to-date.
There was nothing mentioned in the interviews that suggested that they couldn't keep up with
technology.  However, all of the interviewees are employed and successful in their work; others
may not be. Karger & Rose state that 73% of PWD are unemployed (2010, p. 77).  Another item
to consider is that the surge in voice-activated devices could very well likely usher in a new
exclusionary period for those that are DHH.

> Purchases made through devices like Google Home and Amazon's Echo are projected to
> leap from $2 billion today to $40 billion by 2022, as technology improves, U.S. consumers
> become more comfortable, and the speakers become nearly as commonplace in homes as
> a flat-screen TV, according to a new study from OC&C Strategy Consultants. (Jones, 2018)

It can be assumed, however, that gone are the days when a child that is deaf sits through
years of elementary school with no AT and no interpreter only to return home for "night school"

where a parent teaches and reviews the things that were discussed in school that day. Such was the experience of Interviewee #5. Hopefully, because of the improved and more available technologies, there will be fewer people who felt like Interviewee #2 did at one time: "I was jealous of those who didn't have to be like me."

**Practical Applicability.** A study such this could be beneficial to a number of groups and organizations. First of all, the designers and builders of assistive technology would benefit from understanding what is working and what is not working well for the DHH community, and if expanded, to all PWD. Secondly, the designers and builders of mobile smartphones such as Samsung and Apple would find it helpful to know how much their phones are being used by PWD and for what purpose. Since an increasing amount of AT is mobile-based, telecommunication providers such as Sprint could benefit by understanding the needs and wants of current and potential customers. Organizations and companies that operate senior housing and assisted living centers could use this study to become acquainted with technologies that could help their residents, many of whom may be hard of hearing or deaf. Advocacy groups within and on behalf of the DHH community could use this study to plan their future campaigns. If there is a governmental or company-wide policy that is negatively affecting the DHH community in their "system," it could possibly come to light through such a qualitative study. Educational institutions could help prepare students for future work (in technology, business, education, or social justice) by using this study as a reference.

**Recommendations for further research.** As stated above, this particular study is limited because of the homogenous nature of the participants. Further research that includes a variety of races, socioeconomic statuses, and ages could give a more comprehensive result.

Alluded to in the literature review, a research study investigating the question "Does the term 'assistive technology' perpetuate the dividing line between PWD and those without a disability?" could be enlightening. Qualitative and quantitative data could be gleaned from interviews and opinions shared by PWD, technology designers, builders, and distributors, as well as the general population that would indicate to what degree the term influences world views.

An interesting study would be to research the differences of opinions about AT within the community, based upon the participants' ages: "How much of a factor is age in PWD's opinions and use of AT?" As in society as a whole, the oldest members are more likely to be less familiar with technology (not just AT), while the youngest are immersed in it because it is what that they have known throughout their entire lives. Those different generational experiences and opinions about AT of the past and of the future could be eye-opening and informational for each of the groups mentioned in the paragraph above. A study of this nature could be approached in the same manner as this current one: a qualitative research approach, interviewing various people within the DHH communities around the country. Local deaf clubs and organizations could be a source of participants, as could national organizations. Schools and universities (both deaf and hearing) who serve DHH students could also be contacted. Starting the project with focus group discussions might be helpful in order to find out the specific differences.

A third question that should be researched is "How do members of the DHH community whose first language was ASL compare in their satisfaction with and usage of technology (writing-based) with those whose first language was English?" Technology in this country is based on the English language, yet many of the DHH community may not have learned English until later in their school years. Is this a factor in their lives, or is it a non-issue? School-age young people from grade school through college could be the focus because learning a language comes early in

life, and differences may be more apparent before one reaches adulthood. Both quantitative and

qualitative methods could be used.

Fourthly, a study centered on employers and their attitudes toward hiring PWD could be

revealing and encouraging at the same time. Since PWD still have to fight for accommodations,

and employers are often leery of hiring someone with a disability, a study of this nature with

emphasis on how AT has helped or hindered this process could be beneficial. It would be

imperative to interview employers who have already hired those within the disability community.

They could be set up as examples (if merited) for others to follow. Employers who have negative

attitudes and/or practices concerning PWD and who would be willing to participate might be

difficult to find, however. In that case, public quantitative documentation may be able to give

indications about the company's policies and procedures. Investigative journalism tactics may be

needed, such as finding employees of these companies who would be willing to be anonymous

sources. This would be an important project in detailing the level of compliance to the ADA.

**Illustrations**

Illustration 1: old teletype machine: www.baudot.net/teletype/pics/M28-KSR-1.jpg

Illustration 2: Navy women typing on TTY: www.navy-radio.com/tty.htm

Illustration 3: newer TTY:  www.tech-faq.com/tty-tdd.html

Illustration 4: captioning box for television, 1980: www.everybody.si.edu/media/610

Illustration 5: CapTel ® captioned telephone: www.captel.com

Illustration 6: VRS graphic: www.adcommunications.org.uk/video-interpreting/we-provide/

Illustration 7: CART in progress during a live meeting:

www.ccacblog.files.wordpress.com/2012/04/cart-at-conference-2012-thanks-to-h-v.jpg

Illustration 8: Note taker using computer to assist another:  www.isleinterpret.com

Illustration 9: Relay Hawaii VCO graphic:  www.relayhawaii.com/voice-carry-over

Illustration 10: Captioned telephone service graphic: www.sprintcaptel.com/solutions-by-sprint/

Illustration 11: 1970s Bell System "Picturephone":

www.beatriceco.com/bti/porticus/bell/telephones-picturephone.html

Illustration 12: 1990s AT&T videophone: www.beatriceco.com/bti/porticus/bell/telephones-picturephone.html

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