Title

Fulfilling the promise of the personal computer : the development of accessible computer technologies, 1970-1998

Author

Petrick, Elizabeth

Publication Date

2012

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA, SAN DIEGO

Fulfilling the Promise of the Personal Computer: The Development of Accessible Computer Technologies, 1970-1998

A dissertation submitted in partial satisfaction of the
requirements for the degree
Doctor of Philosophy

in

History (Science Studies)

by

Elizabeth Petrick

Committee in charge:

Professor Cathy Gere, Chair
Professor Kelly Gates
Professor Tal Golan
Professor Charles Thorpe
Professor Robert Westman

2012

This dissertation of Elizabeth Petrick is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

____

____

____

____

____
Chair

University of California, San Diego

2012

TABLE OF CONTENTS

ACKNOWLEDGMENTS

This dissertation would not have been possible without the help and guidance of many people. First, I would like to thank my graduate advisor, Cathy Gere, for providing me with detailed feedback on the many drafts I went through to get to this point. She has done her best to make me a better writer, and I will always appreciate it. I also want to thank Charles Thorpe for making the time to run a dissertation workshop group with all of his students; his and their feedback has been invaluable, particularly in helping me to consider interdisciplinary views. I am also grateful to Tal Golan, Robert Westman, and Kelly Gates for their encouragement and feedback along the way.

The graduate students at UC, San Diego–in History, Science Studies, and elsewhere–have helped me, throughout my time here, to bounce ideas off of and to provide necessary critique, in particular: Kevin Walsh, Monica Hoffman, Katrina Petersen, Krystal Tribbett, Bob Long, Emily Lee, Alexandra Vinson, and Jon Stern.

I cannot thank my friends and family enough for their support, in getting me here and enabling me to finish. I want to thank Holly Zynda for her copy editing expertise and Kristofer Lee for endless conversations where I mulled over problems. Finally, I never could have done this without the support of my parents, who encouraged me to change disciplines entirely and work toward a goal that seemed a very long way off when I started.

VITA

2003	Bachelor of Science, University of Michigan
2008	Graduate Advisory Editor, *Science, Technology, & Human Values*
2009	Master of Arts, University of California, San Diego
2006-2009	Teaching Assistant, Sixth College University of California, San Diego
2009	Graduate Student Researcher, Sixth College University of California, San Diego
2012	Graduate Student Researcher, History Department University of Oregon
2012	Doctor of Philosophy, University of California, San Diego

PUBLICATIONS

Kaczmarczyk, Lisa K., Elizabeth R. Petrick, J. Philip East, and Geoffrey L. Herman. "Identifying Student Misconceptions of Programming," *Proceedings of the Twenty-Second SIGCSE Technical Symposium on Computer Science Education* (Milwaukee, WI, March 10-13, 2010).

ABSTRACT OF THE DISSERTATION

Fulfilling the Promise of the Personal Computer:
The Development of Accessible Computer Technologies, 1970-1998

by

Elizabeth Petrick

Doctor of Philosophy in History (Science Studies)

University of California, San Diego, 2012

Professor Cathy Gere, Chair

In this dissertation, I examine the historical development of accessible personal computer technologies for people with disabilities, within the United States. I discuss the creation of these technologies within large, mass-market computer companies and small, third-party developers, along with their promotion and dissemination by disability and technology advocacy groups. I argue that accessible personal computer technologies were a part of the struggle for civil rights for people with disabilities, which became enacted

through technological accommodations that allowed for new abilities and new forms of social participation.

I divide my analysis into five parts: First, the emergence of civil rights legislation for people with disabilities in the 1960s and 1970s, alongside the use of earlier computer technology by professionals with disabilities and computer researchers trying to benefit people through cutting-edge technologies designed for their use. Second, I examine the creation of early accessible technologies within the personal computer industry and their promotion by disability activist groups, who disseminated knowledge and expertise to potential consumers, while providing feedback on users' needs to developers. Third, as computer technology began to standardize in the mid-1980s, I study the role of corporate philanthropy in furthering the development of accessible technologies and in channeling resources to non-profit organizations and individuals with disabilities. Fourth, the revitalization of the disability rights movement, in the late-1980s, led to the passage of stronger civil rights legislation for people with disabilities; I examine these laws and their affects on disability and technology advocacy groups. Fifth, I conclude with an analysis of accessible personal computer software, in the 1990s, as computer technology stabilized and accessibility had become mainstream, while new challenges remained to ensuring personal computers could work with the needs of all users.

The development of accessible personal computer technologies for people with disabilities involved a struggle to fulfill the promise the technology holds: to enact civil rights and allow for fuller participation in society, to augment human abilities and provide for new forms of social interaction, and to meet the needs of all users as a universal technology.

Chapter 1

Introduction: The Development of Accessible Personal Computer Technologies

> "With regard to the major physical and sensory disabilities, I believe that in a couple of decades we will come to herald the effective end of handicaps. As amplifiers of human thought, computers have great potential to assist human expression and to expand creativity for all of us." Raymond Kurzweil, 1999.[1]

Raymond Kurzweil, prominent computer technology innovator and futurist philosopher, began his work on cutting-edge technology in the mid-1970s, with an initial goal of developing optical character recognition technology that could read any style of printed text and translate it into digital text on a computer. After talking with a blind man on a plane trip, Kurzweil decided to focus his technology to aid blind and visually impaired people, as a way to "overcome this principal handicap of blindness," as he saw it—that is, the inability to read printed texts.[2] In 1976, the Kurzweil Reading Machine had a working prototype which could scan printed texts and translate them into speech. There was immediate interest in the technology; after seeing it featured on the *Today Show*, Stevie Wonder contacted Kurzweil's company and was given their second ever version of the machine.[3] The Reading Machine was not Kurzweil's only accessible technology. In 1982, Kurzweil's company created the Kurzweil Voice: general purpose dictation software that was the descendent of specialized medical dictation technology.

1 Raymond C. Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York: Viking, 1999), 178.
2 Ibid., 174.
3 Ibid., 175.

He found that this software was particularly useful for people whose disability affected the use of their hands, by allowing them to compose text in word processing software by speaking.[4]

Kurzweil predicted that one day advanced computer technologies would eradicate disability itself, first by accommodating all the needs of people with disabilities and finally by fixing their bodies. In Kurzweil's vision of the future, computer technology created for people with disabilities was the first step in people transcending the limitations of their bodies, by altering what it means to be human. Here, people with disabilities act as the paradigmatic computer users; technology created for their use is the foundation for technologies which will augment all humans. Computer technology must be designed specifically for people with disabilities—making their needs primary—before its scope can be expanded to include everyone. The history I tell here shows how the creation of accessible personal computer technologies actually played out, not in a futurist vision of ever-accelerating technological progress toward a state of bodilessness, but in the actual development of personal computer technologies for people with disabilities. Instead of a technology developed with ideas of normalcy that excluded the needs of people with disabilities, I find a struggle by activists, developers, and users to build the needs of different people into the forefront of the development process. Many of the technologies created specifically for people with disabilities then went on to find broader use, by accommodating many different kinds of uses, both intended and unforeseen.

As a part of accommodating physical needs, personal computer technology plays

[4] Ibid., 177.

a political role in the historical enactment of civil rights for people with disabilities. The development of accessible technologies intersected with the history of civil rights and the emergence of identity politics; as disability became a identity that people could apply to themselves and their consciousness as a marginalized population within society grew, people with disabilities increasingly advocated for changes to the social environment that would address their concerns with equity. Technological accommodation, both in the form of personal technology and the public built environment, is necessary for people with disabilities to experience full participation in a society which has not been built with their needs in mind. However, the technology alone does not change anyone's lives for the better; people must be aware of it and it must be available to them for its benefits to be realized. This is an aspect of technological development and use that is missing from Kurzweil's perspective. Social technologies, in the form of networked advocacy groups, had to be created to share information and disseminate knowledge to consumers, in order for accessible personal computer technologies to reach users. In some instances, federal anti-discrimination legislation was necessary to mandate access to computer technologies. I analyze accessible personal computer technology in three forms: as a political technology, making equity possible; as a legal technology, required and funded by the federal government; and as a social technology, creating new forms of information sharing and communication. For its potential as a political technology to be realized, these technologies had to be built; in the history of accessible personal computer technologies, corporate philanthropy played an essential role in both creating technologies and supplying them to users. First though, who counted as a user had to be rethought for these technologies to work for a variety of uses. By embracing the values behind what would become universal design, the needs of different people were met by creating technologies that were flexible enough to accommodate bodily differences. This occurred starting with hardware and the physical input and output devices people use to interact with the computer, before moving on to software which allowed people to experience the same technological functions in different ways. Legally, some of these accessibility developments became mandated by the government, in order for the civil rights potential of the technology to be realized. As a social technology, the personal computer was a part of its network of technological dissemination; informing people of what was available and what was possible. On a more personal level, the technology also enabled new forms of communication for users. These three aspects of the development of accessible personal computer technology I trace fit in well with Kurzweil's philosophy of technology changing individual lives, but beyond personal use lies a social level absent from his view, where technology is built within companies, promoted and disseminated by activists, talked about and requested by users, and legislated by the government.

People with disabilities have historically struggled, in the United States, for equal rights and equal participation in society. All three aspects of the technology—political, legal, and social—come together in the form of technological accommodations to enact civil rights. For these rights to be realized, equal access had to be built into the technology. This is the opposite of Kurzweil's valorized posthuman account of the history of technology; the development of accessibility was fundamentally *human,* a part of political movements with a long history of struggling for equality. It was practical, not visionary, a search for solutions to individual and social problems. Federal legislation that prohibits discrimination on the basis of disability attempted to provide for equal rights through the means of technological accommodation, involving technologies such as the personal computer. At the same time, disability activists, brought together by a new sense of common identity, pushed for technologies which could improve their lives. Technology can provide a means to physically overcome some of the barriers in society that disable people, such as braille printed on signs in buildings or closed captioning on TV, but it can also be applied more problematically as a way to 'fix' the bodies of people with disabilities, treating the individual as the problem that needs solving rather than their environment. The actors I follow tend to view technology in utopian and celebratory terms, applauding its potential as a means to encourage future development. Yet, new personal computer technologies also introduced new barriers and promoted the argument that it was the users who must adapt instead of the technology changing to accommodate different uses. I argue that the personal computer has come to fulfill some of its promise, but not in an unproblematic, straightforward way; the relationship between the technology and the people who used and developed it is one of incessant labor on the part of people with disabilities and activists working to communicate the needs of people with different bodies and influence the direction a developing technology would go so as to institute standards that provided access instead of introducing barriers.

Researchers and innovators, prior to the personal computer, described computers as a technology of human augmentation: one that could provide new kinds of physical and intellectual capabilities. People with disabilities were particular beneficiaries of the possibilities computer technology offered. From the perspective of the computer, as imagined by its designers, all people are limited in ways that the computer can accommodate. People with disabilities are the model computer users, the fundamental use case for computer technology. Efforts focused on meeting their needs coincided with a new paradigm for computer technology of user-friendliness and individual, everyday use. This emphasis on usability overlaps with the gradual emergence of ideals of universal design which became codified in the 1990s. Universal design calls for a consideration of the needs of all users, in order for a technology to be usable by as many people as possible. Instead of designing technology for the 'average' or 'normal' user—the universal human—universal design advocates a new understanding of universality; a technology is universal when it can accommodate all differences in how people need to use it. By focusing attention on the seemingly hard cases—the specialized needs of people with different sensory and physical abilities—a technology becomes more flexible and usable. Computer companies slowly realized the benefits of designing their technology to accommodate more users, as it both expanded their market share by including people with disabilities as consumers and allowed consumers more options in how they chose to use the technology. This marked a gradual shift in general corporate philosophy concerning people with disabilities: from a philanthropic view to one where people with disabilities were a viable market share.

Most of the technologies scholars have studied pertaining to people with disabilities are specialized, assistive devices made to accommodate specific needs. Personal computers are different, because they are a general, consumer technology. Similar to the use of buildings by people with disabilities, personal computers had to be made accessible, with features built into them allowing people with different kinds of bodies and different kinds of abilities to use them. The individualized nature of the technology means that personal computer accessibility may have different meanings for people with different disabilities and affect them in different ways. For some people, it is simply an everyday technology, that must be made accessible so that it can be used for the same purposes as people without disabilities. For others, though, the personal computer is itself an assistive device, granting abilities, such as methods of communication, a person may otherwise not have. The computer carries with it—embedded into its development over time—values of being a universalizing technology, with the potential to be used by anyone for any purpose, similar to the understanding of universality promoted by universal design.

In examining this history of accessible personal computer technologies, I begin with pre-personal computer technologies for people with disabilities and civil rights legislation during the 1970s. Once the personal computer came on the consumer market in the late 1970s, I follow the early innovations into technologies that would make personal computers accessible for people with disabilities. I continue as personal computer technology began to stabilize during the mid-1980s, as standards began to be set. In the mid-1990s, one of the final major shifts in personal computer technology ended with a new kind of user interface. I conclude shortly after this technological change had settled and developers created accessible technologies which could accommodate it.

1.1 Terminology

Before further developing my analytical framework, some of the terminology I use requires explanation. There is currently no consensus on whether to use the phrase *people with disabilities* or *disabled people*. Strong arguments exist on both sides for why one is preferable over the other. Currently, U.S. academia chooses to use *people with disabilities*, as it places the emphasis on the people first and the disability as a secondary aspect. However, groups with certain disabilities, such as blind people and deaf people, prefer to be referred to as such, and I utilize their chosen descriptors. Terminology preferences have changed throughout the past few decades; as such, the actors I follow often use terms which are considered offensive today. In addition to issues of labels, categories of disability are not absolute and have no fixed boundaries. As to who falls within *people with disabilities*, I use the broad definition found in U.S. laws such as the ADA, which includes anyone who has some impairment which affects a major life activity. The activist groups I study tend to be as inclusive as possible, therefore I also err on the side of inclusivity.

Another set of terminology that requires explanation concerns the technology for people with disabilities. There are three terms that appear throughout this history, which have some degree of overlap and are to some extent interchangeable. The broadest phrase I use is *accessible technologies*, which refers to those devices, software, or features of a technology that are intended to provide access to a technology or ability for people. It frequently pertains to people with disabilities, but can also include other access needs. For example, closed captioning on a television or screen reading software which translates text to speech are accessible technologies. *Assistive technologies* are those technologies specifically intended for people with disabilities to aid them in some way, such as wheelchairs or computer keyboards with large, easy-to-press keys. *Adaptive devices* are technologies which allow access based on a specific disability; this is not a phrase I use often, but it does appear in many of my primary sources. Many of the technologies I discuss fit under all three of these terms, though my historical actors sometimes prefer one over the other. For the most part, I utilize *accessible technologies* when discussing personal computer devices and features.

1.2 Theoretical Foundations

I situate my project within the history of technology and science and technology studies (STS). Within the history of technology, I contribute an understanding of the historical use of personal computers by consumers, as well as the development of computer technology features which increased usability and accessibility. I draw upon theoretical frameworks in STS relating to the relationship between the use and development of technology, embodied use, and the politics of technology. I bring the perspective of people with disabilities into both STS and the history of technology, as a way to focus upon a specific consumer population that has a unique and significant relationship to technology. I also work with aspects of disability studies, including the social theory of disability and the relationship between people with disabilities and assistive technologies. By examining disability through computer technology and civil rights legislation, I provide a new look at the role technology plays in enacting civil rights and how both interact with the bodies of different users.

Within disability studies, I draw upon broad concepts related to the social model of disability. The social model of disability draws a distinction between impairment and disability: impairments are physical or mental aspects of the body, disabilities are social barriers preventing full access to participation in society. In his book *Understanding*

Disability: From Theory to Practice,[5] Michael Oliver explains that the social model originated in a 1976 document, the *Fundamental Principles of Disability,* by the British disability rights organization, the Union of the Physically Impaired Against Segregation. This group argued that, "In our view, it is society which disables physically impaired people. Disability is something imposed on top of our impairments by the way we are unnecessarily isolated and excluded from full participation in society."[6] The social model was developed by disability activists and scholars in contrast to models of disability such as the medical or individual model which placed the problem of disability on the individual and their body, a problem which society could attempt to solve by fixing the body and bringing the person with disabilities closer to normalcy.[7]

Working within the social model of disability, Lennard J. Davis traces the historical construction of normalcy since the eighteenth century within art, literature, language, and psychology in *Enforcing Normalcy: Disability, Deafness, and the Body.*[8] Davis argues for a rejection of disability and normality as absolute, unchanging categories. Instead, the differences of the human body should be understood on a continuum: "The term 'disabled' is often used to obscure or repress the fact that disability is not a static category but one which expands and contracts to include 'normal' people as well."[9] For Davis, disability should be considered a descriptive term, not an immutable category, and its social construction understood, in order to bring people with disabilities into the full range of political and social participation: "Only when disability is made

5 Michael Oliver, *Understanding Disability: From Theory to Practice* (New York: St. Martin's Press, 1996).
6 Quoted in ibid., 22.
7 Ibid., 36.
8 Lennard J. Davis, *Enforcing Normalcy: Disability, Deafness, and the Body* (London: Verso, 1995).
9 Ibid., xv.

visible as a compulsory term in a hegemonic process, only when the binary is exposed and the continuum acknowledged, only when the body is seen apart from its existence as an object of production or consumption—only then will normalcy cease being a term of enforcement in a somatic judicial system."[10] Since, within the social model, the problem of disability is a social one, caused by barriers keeping people from disabilities from equal rights and equal access to full political lives, the solution comes from an understanding of the full extent of the limitations placed upon people with disabilities and changing the social environment to accommodate their needs. Disability is connected to the body and to bodily impairments in terms of the assumptions of normalcy which have built up barriers for people with disabilities, but disability is not a medical issue to be treated or fixed; it is a social category and personal identity. With the personal computer technology I study, there is a blurring of the line between changing individual bodies to allow for 'normal' use versus changing the environment to accommodate different uses. I analyze instances where the personal computer is both personal—granting some individuals abilities they otherwise lack—and public—allowing for new spaces of social interaction. Accessible personal computer technologies accommodate uses in both of these domains.

For civil rights to exist, people require access to the political realm; accessibility then is an essential component for politics or equality. Claire H. Liachowitz traces the history of disability and legislation during the twentieth century from a social model perspective, in her book, *Disability as a Social Construct: Legislative Roots.*[11] As with Davis, she treats disability as a continuum that people might move in and out of during

---

[10] Ibid., 157.

[11] Claire H. Liachowitz, *Disability as a Social Construct: Legislative Roots* (Philadelphia: University of Pennsylvania Press, 1988).

their lives. She finds legislation a useful subject to understand disability, because the law points to what society considers problems and how it tries to deal with them.[12] Her argument is that "legislation promotes disability by conditioning the social status of physically handicapped people."[13] People with disabilities are placed into positions of deviance by social and legal constructs, especially those which treat them as subjects of charity. I return to Liachowitz's work in chapter 2 with the emergence of civil rights legislation for people with disabilities which treated them as an oppressed group needing legal protections, instead of one that needed to be rehabilitated to fit into social life.

The history of the disability rights movement and the acquisition of civil rights for people with disabilities are analyzed in a number of works in disability studies. In his book, *From Good Will to Civil Rights: Transforming Federal Disability Policy*, Richard K. Scotch examines the creation of federal civil rights legislation during the 1970s, particularly Section 504 of the Rehabilitation Act of 1973.[14] He shows the roles played by policy makers and the emerging disability rights movement in enacting the law and its regulations. Joseph P. Shapiro follows a broader look at the same topic in his well-known history of disability rights, *No Pity: People With Disabilities Forging a New Civil Rights Movement.*[15] Shapiro highlights the importance of the disability rights movement in drawing public attention to the discrimination faced by people with disabilities. He demonstrates a shift during the mid-twentieth century from disability as a medical subject to the rise of civil rights for people with disabilities, culminating in the passage of the

---

12 Ibid., 2.

13 Ibid., 9.

14 Richard K. Scotch, *From Good Will to Civil Rights: Transforming Federal Disability Policy* (Philadelphia: Temple University Press, 1984).

15 Joseph P. Shapiro, *No Pity: People With Disabilities Forging a New Civil Rights Movement* (New York: Times Books, 1993).

Americans with Disabilities Act of 1990.[16] I discuss both Scotch and Shapiro's works in more detail in chapter 2.

I utilize the social model of disability in considering the significance of personal computer technologies for people with disabilities. These technologies, in some instances, offer partial solutions to problems of disability created by social institutions and constructs, particularly regarding communication[17] and the possibility of conducting everyday business from one's home. I also consider the complexities that go into technological solutions to social problems and the places where technology cannot provide a perfect fit between a user's physical needs and the problems they are attempting to solve. I argue that technological accommodation has been the political solution to the problem of disability; U.S. legislation attempts to grant people with disabilities equal rights by providing for more and better accessible technologies that are intended to offer people access to parts of social life they had previously been denied. The social model seeks to understand the assumptions behind the unequal position of people with disabilities in society as a way to address the problem of disability at its root and find alternative ways to structure society that are more inclusive.

Though technology plays an undeniably significant role in the lives of people with disabilities and the ways they interact with society, disability studies, as a field, has relatively few works tackling the relationship between disabled bodies and technology. This lacunae has been commented upon by the scholars who have attempted to study technology while working with disability studies. In his essay, "What Can the Study of Science and Technology Tell Us about Disability?" Stuart Blume suggests that part of the

---

16 Ibid., 22.

17 For instance, text-to-speech technologies enable someone who is unable to talk to communicate in situations where speaking is required.

hesitation to treat technology, particularly assistive technologies, as an object of study comes from following the social model of disability, “From the perspective of the social model, 'assistive technologies,' typically having their origins in rehabilitation medicine, represented precisely those attempts at compensating for individual impairments that were to be rejected and opposed.”[18] Blume believes that studying technology might make up for some of the problems people have identified in social model, such as its lack of attention to physical impairment, “Studies of technologies can help bridge the conceptual gap that has been created between the social impediments to integration and the embodied experience of disability.”[19] One place where technology has played a central role as a subject of study is with those works that straddle disability studies and other fields. The intersection of STS and disability studies, in particular, is on the rise, with many projects in development looking at both theoretical connections between the two fields and concrete examples where both fields might talk to each other. In addition, there are a number of histories of assistive technologies, such as prosthetic limbs or cochlear implants, that are used exclusively by people with disabilities.

David Serlin traces the history of prosthetics in mid-twentieth century America in his book, *Replaceable You: Engineering the Body in Postwar America.*[20] He examines, “how, in the late 1940s and early 1950s, medical procedures used to rehabilitate or alter the human body enabled a new alignment of civic goals and national imperatives, of material form and ideology, of private possibility and public responsibility.”[21] For

---

[18] Stuart Blume, “What Can the Study of Science and Technology Tell Us about Disability?” in *Routledge Handbook of Disability Studies,* eds. Nick Watson, Alan Roulstone and Carol Thomas (London: Routledge, 2012), 349.

[19] Ibid., 354.

[20] David Harley Serlin, *Replaceable You: Engineering the Body in Postwar America* (Chicago: University of Chicago Press, 2004).

[21] Ibid., 1.

example, post World War II, the physical rehabilitation of war veterans was viewed as a type of national rehabilitation for the country as a whole. Serlin analyzes the meaning of the American body and the ways that prosthetics demonstrated social anxieties about the completeness and health of the, particularly masculine, body.[22] A number of interdisciplinary scholars consider the history of prosthetics in a volume coedited by Serlin, Katherine Ott, and Stephen Mihm, *Artificial Parts, Practical Lives: Modern Histories of Prosthetics.*[23] These scholars seek to recapture the historical reality of the development and use of prosthetics, away from the more abstract and metaphorical meaning where prosthesis can describe any human-machine interface. They utilize a material-culture approach in order to get at the history of prosthetics as an highly intimate and personal embodied technology.[24]

Examining the meanings of another specific assistive technology, Catherine Kudlick provides an autobiographical account of her training in use of a white cane for blind people in her article, “The Blind Man's Harley: White Canes and Gender Identity in America.”[25] Kudlick explores the relationship of the white cane to both symbolic and performative gender. After going through the very masculine white cane training program at the Colorado Center for the Blind, Kudlick comes to understand more about her own fears of blindness and the need for risk-taking for people with disabilities:

> Through their unbridled audaciousness, my fellow students and teachers—all of them blind—rescued blindness from the depths of pity and helped turn it into simply another way of being in the world. At the same time, I had to change how I

---

22 Ibid., 25.

23 Katherine Ott, David Serlin, and Stephen Mihm, eds., *Artificial Parts, Practical Lives: Modern Histories of Prosthetics* (New York: New York University Press, 2002).

24 Katherine Ott, “The Sum of Its Parts: An Introduction to Modern Histories of Prosthetics,” in *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*, eds. Katherine Ott, David Serlin, and Stephen Mihm (New York: New York University Press, 2002), 3.

25 Catherine Kudlick, “The Blind Man’s Harley: White Canes and Gender Identity in Modern America,” *Signs: Journal of Women in Culture and Society* 30, no. 2 (2005): 1589-1606.

> thought about myself as a woman in order to triumph over adversity in this particular way.[26]

The technology of the white cane here was embedded with values of machismo and independence that encouraged blind people to put themselves out into the world and reject notions of helplessness and stereotypes of femininity.

Though focused on the labor of production instead of the use of an assistive technology, Gregory J. Downey conducts an examination of the history of closed captioning technologies and the workers who caption various types of programming in *Closed Captioning: Subtitling, Stenography, and the Digital Convergence of Text with Television*.[27] He bridges the history of technology and human geography, while drawing upon disability studies. One of his goals is to address the invisibility of the work that goes on behind the scenes with captioning speech to text, instead of focusing on the producers or consumers of the materials being captioned. He points to the importance of spatial geography in the coming together of different groups in forming the intertwined technologies and people who make up different types of captioning.[28] Downey is interested in the historical construction of the system of closed captioning which is composed of both technologies and labor. He argues for the co-construction of closed captioning—influenced by both social structures and technologies that change over time.[29]

Unlike specialized assistive devices, however, there are fewer works examining everyday technologies, used by everyone, and people with disabilities. Within urban

---

26 Ibid., 1590.
27 Gregory J. Downey, *Closed Captioning: Subtitling, Stenography, and the Digital Convergence of Text with Television* (Baltimore: Johns Hopkins University Press, 2008).
28 Ibid., 12.
29 Ibid., 298.

studies there is some attention to the need for universal access and removal of architectural barriers preventing the usage of buildings and transportation systems by people with certain disabilities.[30] These technologies are an example of disability access that is recognizable to most people, as U.S. legislation passed since the late 1960s has required that buildings be constructed or modified to be accessible, particularly for blind people or people using wheelchairs. Access to buildings is an example of the politics of infrastructure; without the ability to enter and navigate public buildings, people cannot fully participate in society. Buildings are where social and political life takes place. While there are some works on private spaces, such as homes, most attention to accessible buildings concerns public spaces and federal requirements of access.

Computers may not be as essential a part of everyday life as buildings, but during the last few decades, the technology has become ever more integrated into the activities of social life. A few disability studies scholars have considered some of the ways people with disabilities interact with computer technology. These works apply the social model of disability as a way to avoid technological determinism. Technology cannot solve the problem of disability by fixing what is wrong with the body; instead social changes must be made regarding assumptions of how the social environment needs to be used by people with different bodies. In *Enabling Technology: Disabled People, Work, and New Technology,* Alan Roulstone discusses the promise new digital technologies offer to change the way work is conducted.[31] He argues that new technologies can create more

---

30 Brendan Gleeson, "A Place on Earth: Technology, Space, and Disability," *Journal of Urban Technology* 5, no. 1 (1998): 87-109; Jon A. Sanford and Bettye Rose Connell, "Accessible Seating in Stadiums and Arenas," *Journal of Urban Technology* 5, no. 1 (1998): 65-86; Lennie Scott-Webber and Anna Marshall-Baker, "Two Contrasting Approaches to Urban Accessibility for Individuals with Disabilities or Special Needs," *Journal of Urban Technology* 5, no. 1 (1998): 1-15.

31 Alan Roulstone, *Enabling Technology: Disabled People, Work, and New Technology* (Philadelphia: Open University Press, 1998).

accessible work environments and even challenge stigmas surrounding disability, but that this potential will not necessarily become reality; digital technologies could end up creating new barriers if their use by people with disabilities is not understood.[32]

Gerard Goggin and Christopher Newell work in between disability studies, media and cultural studies, and STS in order to provide a critical analysis of new media technologies and people with disabilities in *Digital Disability: The Social Construction of Disability in New Media.*[33] They examine the relationships between disabilities and technology, with a focus on digital communication technologies that are meant to redress disadvantages people face; considering technologies such as cochlear implants, telecommunication technologies, networking technologies, and digital broadcasting, they seek to understand what is taken for granted with these technologies in terms of the values and assumptions embedded in them.[34] The authors complicate the promise of these technologies by recognizing the inequalities people with disabilities face and the politics of who has control over development and who is disabled by new technologies:

> A governing concept for us is the control of disability as a contested sociopolitical space. Disability is more than deviant bodies, challenging minds, or pitiful individuals with special needs. Societies build disability into those physical and social structures we take for granted, especially where those with power have excluded the knowledge and life-experience of those who live with disability.[35]

By examining the space of disability within these new technologies, the authors seek to demonstrate the way new media technologies fail to live up to their promise for people with disabilities and instead build in new barriers—creating new forms of disability in

---

32 Ibid., 14.

33 Gerard Goggin and Christopher Newell *Digital Disability: The Social Construction of Disability in New Media* (Lanham, MD: Rowman & Littlefield Publishers, Inc, 2003).

34 Ibid., xvi.

35 Ibid., 31.

society.[36]

In *Disability and New Media,* Katie Ellis and Mike Kent build upon the work of Goggin and Newell in examining accessibility and barriers in the internet today.[37] Analyzing social networking sites and other web 2.0 platforms, Ellis and Kent show how the liberatory promise of the internet has often failed people with disabilities. They see problems of disability and the internet functioning as a reflection of broader worries about technology: "Disability has a narrative significance in the internet's history by operating as symbolic of wider cultural anxieties regarding a lack of access."[38] As the internet, and in particular, web 2.0 platforms consist of user-generated content, accessibility is both produced and prevented dynamically by people who often lack awareness of the barriers they are creating or the standards that exist to enable access for everyone.[39] The authors' goal is to draw attention to the problem of lack of accessibility on the internet and encourage the development of web platforms using universal design ideals.

Disability studies provides my work with an awareness of the social construction of disability and the relationship between disabled bodies and the technologies which are promised to overcome disability and also create barriers. I utilize the social model to draw a distinction between bodily impairments and social disabilities, while acknowledging that neither are absolute categories; attempting to solve the problems of disability created by social barriers has to work with the abilities people's bodies provide them. As I will show, personal computers can function as assistive technologies which

---

36 Ibid., 147.
37 Katie Ellis and Mike Kent, *Disability and New Media* (New York: Routledge, 2011).
38 Ibid., 10.
39 Ibid., 59,61.

allow all people new abilities but were also developed with assumptions about imagined users that often excluded people with disabilities.

Within the history of technology, I contribute an examination of the use of personal computers, a subject mostly absent from academic computer history. There are many histories of computer development, but these tend to focus on the perspective of computer companies and engineers. I draw upon some of these in order to understood the broader context of computer development surrounding the more specific parts of accessible personal computer technologies I study. One of the core texts in the history of computers is Paul Ceruzzi's *A History of Modern Computing,* in which he chronicles the major developments in computer technologies beginning with the transition from punched-card machines to the first vacuum-tube electronic computers in the late 1940s and early 1950s, to the development of silicon integrated circuits in the late 1960s and early 1970s, the emergence of the personal computer in the late 1970s, and networked computers in the 1980s and 1990s.[40] Ceruzzi examines the values that were embedded into the computer throughout this history: values of both democracy and control.[41] Using a co-construction framework, he argues that the development of the computer was a part of its historical context, be it during postwar prosperity or the Cold War.[42]

Other significant works within the history of computers analyze more specific parts of the history of its development. In *The Closed World: Computers and the Politics of Discourse in Cold War America*, Paul Edwards analyzes the computer in both its

---

[40] Paul Ceruzzi, *A History of Modern Computing,* 2nd ed. (Cambridge, MA: MIT Press, 2003).
[41] Ibid., 10.
[42] Ibid., 7.

technical form and its importance as a cultural metaphor during the Cold War.[43] He argues that the computer both shaped political thought during the Cold War and was, in turn, shaped by it; the politics of Cold War discourse were centered on the interaction of humans and machines. Edwards sees the discourse of cyborgs as a counterpart to the closed-world politics of the Cold War.[44] Examining a more recent aspect of computer history, Janet Abbate studies the history of the internet, from the creation of pre-internet networking to the evolution of the military ARPANET into the public World Wide Web, in *Inventing the Internet*.[45] She is interested in the social shaping of internet technology and draws attention to the role of users in this history, arguing that "much of the Internet's success can be attributed to its users' ability to shape the network to meet their own objectives."[46] The importance of users here is due to two factors: the initial creation of the ARPANET by those who would use it and its flexible design allowing users to create new features. Abbate also analyzes the military influences on the development of the internet, particularly in the dominance of values "such as suvivability, flexibility, and high performance, over commercial goals, such as low cost, simplicity, or consumer appeal."[47] It was within the sometimes conflicting goals of military and civilian interests that the internet developed and made possible that which it is used for today.

Some works on computer development blur the line between producers and consumers by considering the role of computer professionals and hobbyists as both early users and developers of personal computer technology. Examining the history of

---

43 Paul Edwards, *The Closed World: Computers and the Politics of Discourse in Cold War America* (Cambridge, MA: MIT Press, 1996).
44 Ibid., 2.
45 Janet Abbate, *Inventing the Internet* (Cambridge, MA: MIT Press, 1999).
46 Ibid., 5.
47 Ibid.

computer software from the perspective of computer specialists, Nathan Ensmenger analyzes the emergence of computer programmers as the first computer users in *The Computer Boys Take Over: Computer, Programmers, and the Politics of Technical Expertise*.[48] He argues that these "computer boys" were the ones to most directly bring about the development of the computer revolution, as they were the ones who wrote what the computer now is for most people: its software.[49] Studying software crises throughout the mid-twentieth century, Ensmenger charts the rise of computer programmers as a profession and their authority and power in shaping the development of the computer and its use in society. Paul Freiberger and Michael Swaine consider another group of computer professionals who influenced the technology in their popular history examination of the origins of Silicon Valley personal computer companies, *Fire in the Valley: The Making of the Personal Computer*.[50] The authors argue for the importance of hobbyists in shaping the way the personal computer developed.[51] It was computer enthusiasts who sought to make the computer into a personal technology, where individuals would have complete control over their own machine. They also criticize the way personal computers became big business and the industry lost sight of the earlier ideals of what computer technology was capable of in connecting people together in new ways.[52]

Some of the ideals and values embedded into the personal computer by early researchers are discussed in Thierry Bardini's, *Bootstrapping: Douglas Engelbart,*

---

48 Nathan Ensmenger, *The Computer Boys Take Over: Computer, Programmers, and the Politics of Technical Expertise* (Cambridge, MA: MIT Press, 2010).
49 Ibid., 5.
50 Paul Freiberger and Michael Swaine, *Fire in the Valley: The Making of the Personal Computer, Second Edition* (New York: McGraw-Hill, 2000).
51 Ibid., 124.
52 Ibid., 439.

Coevolution, and the Origins of Personal Computing.[53] Bardini traces Engelbart's pioneering research on computers as a means to augment human intelligence and his influence on the development of the personal computer. This notion of augmentation is particularly salient for the meanings personal computers hold for people with disabilities. Engelbart viewed the computer as something like a prosthesis, one that would develop with its user over time to lead to new abilities for people.[54] Both the computer and the user were required to learn from each other, in order to develop and provide people with better ways to live in the world. I draw upon Bardini's account in order to understand how, in the view of early computer developers, the computer might one day function as an intellectual prosthetic device: one that could augment human intelligence and provide new ways for users to interact with the world.

From science and technology studies, I draw upon a number of theories related to technological use, development, and the relationship of technology to bodies. In *Technology and the Character of Contemporary Life,* Albert Borgmann proposes a new theoretical outlook on the relationship of technology to society.[55] He criticizes what he calls the substantive (technology shapes society with no other rivals) and instrumentalist (technology is merely a tool of humans) views of technology. As a way to bridge these theories, Borgmann suggests a pluralist view, where the complexities of technology are acknowledged, but also the patterns of technological development; here, the evolving

[53] Thierry Bardini, *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing* (Stanford, CA: Stanford University Press, 2000).
[54] Ibid., 143.
[55] Albert Borgmann, *Technology and the Character of Contemporary Life* (Chicago: University of Chicago Press, 1984).

trends of technology and forces of interaction are examined.[56] Borgmann argues that the promise of technology makes society's goals vague: “The promise presents the character of the technological enterprise in broad and ambiguous outline, i.e., as the general procurement of liberty and prosperity in the principled and effective manner that is derived from modern science. Thus it keeps our aspirations present and out of focus at the same time.”[57] Using the example of the personal computer, the promise of more effectively conducting certain tasks is aided by the technology's friendliness, but as the computer becomes easier to operate, fewer people actually undertand the workings of its machinery.[58] I analyze this type of blackboxing and its effect on computer users further in chapter 3.

In another broad work on the relationship between use and development of technology, *Human-Machine Reconfigurations*, the follow-up to her book, *Plans and Situated Actions*, Lucy Suchman examines human-machine interaction and the ways people understand new technology.[59] She argues that assumptions regarding the purposeful action of humans inform the design of interactive machines—such as computers—but that conceptions of human action as determined by rational plans are inaccurate; this misconception then becomes reflected in the design of machines, which makes the technology less usable. No matter how intuitive a machine might be designed, all users still have to apply sense-making in order to understand how to operate something new and unfamiliar. For example, Suchman discusses the use of a new copier that was designed to be more intuitive but which users initially found overly complicated:

---

56 Ibid., 11.
57 Ibid., 39.
58 Ibid., 47.
59 Lucy Suchman, *Human-Machine Reconfigurations: Plans and Situated Actions, 2nd Edition* (New York: Cambridge University Press, 2007).

"I argued that the machine's complexity was tied less to its esoteric technical characteristics than to mundane difficulties of interpretation characteristic of any unfamiliar artifact. My point was that making sense of a new artifact is an inherently problematic activity."[60] Suchman suggests that all purposeful action is necessarily situated in a particular context and that human plans are more or less ad hoc because of our inability to successfully predict aspects of our circumstances. As interactive machines need to communicate their use through their design—that is, they must be intuitive to their users—a view of actions and plans that is too universal does not sufficiently account for varied or unintended uses. I encounter some of these problems with new, unfamiliar technology particularly in chapter 3, with the introduction of the mouse and Apple forcibly requiring its use, out of worries that users would otherwise fall back on the more familiar keyboard controls.

Claude Fischer described a similar relationship in his history of the telephone, *America Calling: A Social History of the Telephone to 1940.*[61] Fischer utilizes social constructivism to understand how the telephone came to be, as opposed to other possible technologies or ways of developing, and Ruth Schwartz Cohen's "consumption junction" to analyze how early users took up the technology and made it part of their lives.[62] He dissects both the intended uses the telephone developers marketed it for and the unintended uses to which, notably, rural women put the telephone. Fischer attempts to balance the agency of users in choosing and using technology with the limitations on their agency imposed by larger social structures.[63] Though the telephone was discussed, at

---

[60] Ibid., 9.

[61] Claude S. Fischer, *America Calling: A Social History of the Telephone to 1940* (Berkeley: University of California Press, 1992).

[62] Ibid., 21

[63] Ibid., 269.

the time, as a very radical new technology, Fischer found that the way people used it mostly expanded upon already present parts of their lifestyles, rather than opening up entirely new possibilities.[64]

The conception of use and development I most closely work from—co-construction—is laid out in Nelly Oudshoorn and Trevor Pinch's edited volume, *How Users Matter: The Co-construction of Users and Technology.*[65] These essays complicate our understanding of the ways users and technology relate to and shape each other, as well as how users are defined and who defines them, by drawing upon previous work in STS, feminist scholarship, and cultural and media studies. Co-construction is a methodology that examines the full diversity of users, non-users, and those who speak for users, in every space where technology and users impact each other. By considering such a diverse set of pertinent actors and groups, co-construction finds the relevancy and agency of users in locations and kinds of use previously not studied.[66]

I draw on two essays, in particular, from this collection in order to understand the significance of spokespeople in speaking for users: Shobita Parthasarathy's "Knowledge is Power: Genetic Testing for Breast Cancer and Patient Activism in the United States and Britain" and Jessika van Kammen's "Who Represents the Users? Critical Encounters between Women's Health Advocates and Scientists in Contraceptive R&D."[67]

Parthasarathy discusses certain breast cancer advocacy groups in the United States that

---

64 Ibid., 263.

65 Nelly Oudshoorn and Trevor Pinch, eds., *How Users Matter: The Co-Construction of Users and Technology* (Cambridge, MA: MIT Press, 2003).

66 Ibid., 2.

67 Shobita Parthasarathy, "Knowledge is Power: Genetic Testing for Breast Cancer and Patient Activism in the United States and Britain," in *How Users Matter: The Co-Construction of Users and Technology,* eds. Nelly Oudshoorn and Trevor Pinch (Cambridge, MA: MIT Press 2003), 133-150 and Jessika van Kammen, "Who Represents the Users? Critical Encounters between Women's Health Advocates and Scientists in Contraceptive R&D," in *How Users Matter: The Co-Construction of Users and Technology,* eds. Nelly Oudshoorn and Trevor Pinch (Cambridge, MA: MIT Press 2003), 151-171.

intentionally pushed against a free market uptake of breast cancer gene testing, where users would have access to any test they desired. Instead, the groups argued that people needed to have their options limited, so that they would be protected from uninformed, and potentially harmful choices. Enforcing good medicine for people was valued as more important than individual agency.[68] In von Kammen's essay, she explores the process through which women's health advocates came to represent users to the contraceptive industry. These groups did not present themselves as speaking for users or giving voice to all of their needs, but instead acted more like political representatives. They provided the users' perspectives that industry needed, in a way that would allow the advocates to influence research to fit the goals of the women's health groups.[69] Both of these cases demonstrate relationships between users and spokespeople that are more complicated than activists providing a direct, unfiltered voice for the people they represent. These essays are particularly relevant as many of the activists I discuss act as spokespeople for computer users with disabilities.

One of the most well-known works within STS that blurs the lines between users, spokespeople, and producers is Steven Epstein's *Impure Science: AIDS, Activism, and the Politics of Knowledge.*[70] In writing about the role AIDS activists played in promoting and testing new drugs, Epstein demonstrates how laypeople can make themselves into experts. He argues that, “the interventions of laypeople in the proclamation and evaluation of scientific claims have helped shape what is believed to be known about AIDS—just as they have made problematic our understanding of who is a 'layperson' and

---

68 Parthasarathy, "Knowledge is Power,” 140.
69 Van Kammen, "Who Represents the Users?” 160.
70 Steven Epstein, *Impure Science: AIDS, Activism, and the Politics of Knowledge* (Berkeley: University of California Press, 1996).

who is an 'expert.'"[71] I apply this blurring of laypeople and experts in the construction of knowledge to my examination of disability and technology activists. As I will show in chapter 3, the parents of children with disabilities I follow made themselves into experts of cutting-edge computer technology, in order to both immediately benefit their families and to shape the on-going development of accessible technologies.

Another STS idea I use is that of 'tinkering.' In *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science,* Karin Knorr-Cetina described the tinkering of scientists as:

> Tinkerers are opportunists. They are aware of the material opportunities they encounter at a given place, and they exploit them to achieve their projects. At the same time, they recognise what is feasible, and adjust or develop their projects accordingly. While doing this, they are constantly engaged in producing and reproducing some kind of workable object which successfully meets the purpose they have temporarily settled on.[72]

Tinkering is a way of making a technology fit needs; this could involve scientists making the objects of their research fulfill the goals of their projects or users making a consumer technology work with their needs to solve their problems. In Monica Casper and Adele Clark's article, "Making the Pap Smear into the 'Right Tool' for the Job: Cervical Cancer Screening in the USA, circa 1940-95," they demonstrate the necessity of tinkering in making the Pap smear work as the technology of cervical cancer screening.[73] The kinds of tinkering they describe concern infrastructure and the organization of labor instead of making the technology physically fit needs.[74]

Aspects of tinkering occur pertaining to a computer in the case study analyzed in

---

71 Ibid., 3.

72 Karin Knorr-Cetina, *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science* (Oxford: Pergamon Press, 1981): page 34.

73 Monica J. Casper and Adele E. Clark, "Making the Pap Smear into the 'Right Tool' for the Job: Cervical Cancer Screening in the USA, circa 1940-95," *Social Studies of Science* 28, no. 2 (1998): 255-290.

74 Ibid., 256.

Christine Lindsay's chapter in *How Users Matter,* “From the Shadows: Users as Designers, Producers, Marketers, Distributors, and Technical Support.”[75] Lindsay examines past and present incarnations of TRS-80 computer users, in order to understand the co-construction of users and technology in a situation where there are no longer any producers, but only users. Many of the current users identified themselves explicitly as “tinkerers;” one important way their tinkering played out was to improve upon the technology so that it better fit their uses, after a point where the producers ceased to support or make official changes to the computer. These users' tinkerings included fixing remaining operating system bugs—making the TRS-80 into a machine that was faster and more usable than the one developed by Radio Shack twenty years earlier.[76] Tinkering features prominently in this study, notably in chapter 3, when, in the early days of the personal computer, an entire system of technologies had to be assembled and made into a working whole, sometimes by tricking the computer into thinking a mainstream device was being used instead of a specialized one it could not interpret correctly.

I also utilize the STS concept of the 'black-boxing' of science and technology. In engineering, a 'black box' refers to a technology or process where only the inputs and outputs are known; its inner workings or implementation are hidden. STS takes this idea further and considers the social and political implications of black-boxing. Bruno Latour and Steve Woolgar develop this concept in *Laboratory Life: The Construction of Scientific Facts*.[77] They describe the creation of black boxes in science as “the rendering

---

75 Christine Lindsay, "From the Shadows: Users as Designers, Producers, Marketers, Distributors, and Technical Support," in *How Users Matter: The Co-Construction of Users and Technology,* eds. Nelly Oudshoorn and Trevor Pinch (Cambridge, MA: MIT Press 2003), 29-50.

76 Ibid., 48.

77 Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton, NJ: Princeton University Press, 1986).

items of knowledge distinct from the circumstances of their creation."[78] Thus, the results given as output by a scientific device are taken as the output of whatever experiment was being conducted, without an understanding of the details of the technology that go into producing that result. Only the inputs and outputs are known, how the device uses the former to create the latter remains unknown. A black box affects its use by hiding the details of historical context within which it was created, making challenges to it difficult: "Once a large number of earlier arguments have become incorporated into a black box, the cost of raising alternatives to them becomes prohibitive."[79] Black boxing makes aspects of a technology unquestionable, and in the cases I examine, sometimes directly inaccessible. I show, in chapter 3, how the increasing black-boxing of the personal computer, in the name of user-friendliness, limited access to its inner machinery, decreasing the flexibility of the computer for alternative uses, and preventing access for people with certain kinds of disabilities.

There is a rich group of works within STS and cultural and media studies focused on the embodied use of technology. The authors of these works study the interaction between technologies and bodies in a way that acknowledges that all use is embodied, and which seeks to understand the role played by bodily differences. These differences frequently concern issues of gender and race; people with disabilities—and the significant differences between bodies that are revealed when studying disability—are mostly absent. In Anne Marie Balsamo's *Technologies of the Gendered Body: Reading Cyborg Women*, she examines the role technologies play in creating new possibilities for bodies: "Although the popularization of new body technologies disseminates new hopes

---

[78] Ibid., 259.
[79] Ibid., 242.

and dreams of corporeal reconstruction and physical immortality, it also represses and obfuscates our awareness of new strains on and threats to the material body."[80] She discusses the relationship between new bodily technologies and gendered bodies, examining places where these technologies construct gendered bodies and ideas of gender shape biotechnologies. Also working with ideas of women's bodies and digital technology, Amanda du Preez, in *Gendered Bodies and New Technologies: Rethinking Embodiment in a Cyber-era*, argues for the necessity of studying from a perspective of embodiment, as "there is no existence possible without embodiment of some sort."[81] She argues against ideas of new digital technologies creating possibilities of bodilessness: "Throughout the text bodies are perceived to be constantly changing and adapting to technologies, just as technologies change and adapt to bodies, but at no stage are bodies perceived as fatally disappearing into virtual oblivion."[82] Du Preez argues that the only way to understand the relationship between bodies and technology is in their individual interactions; there is no inevitable and assumed evolution toward bodilessness, only the here-and-now, discrete, physical instances of embodied use.

Though these authors frequently discuss assistive technologies—prosthetics are a common example—they do not, for the most part, explicitly analyze the meaning of these technologies in terms of their relationships with disability. In my work, I extend these ideas of embodied technologies into sites of highly diverse bodily differences, in order to understand the meaning of embodied technologies—specifically, the personal computer—for users with disabilities.

---

[80] Anne Marie Balsamo, *Technologies of the Gendered Body: Reading Cyborg Women* (Durham, NC: Duke University Press, 1996): 2.

[81] Amanda du Preez, *Gendered Bodies and New Technologies: Rethinking Embodiment in a Cyber-era* (Newcastle upon Tyne: Cambridge Scholars Publishing, 2009): xvi.

[82] Ibid., xvii.

One example within studies of bodies and technology where disability is an analytic category is in an essay by Michael L. Dorn, "Beyond Nomadism: The Travel Narratives of a 'Cripple.'"[83] Dorn examines the writings of Patty Hayes, a disability activist and designer who, over time, came to rethink her relationship with her wheelchair and the built environment in which she attempted to travel and encountered barriers. He uses Hayes's writing to criticize the valuation of the cyborg and nomad in feminist studies as ableist, arguing that "I would like to show, first, how some poststructuralist feminists ignore institutional sedimentations in the built environment, assuming instead an apparently obstacle-less, frictionless plain of social interaction."[84] These assumptions of the built environment being traveled by people who do not have disabilities misses the reality of the relationship between bodies and technologies in the form of those people who must navigate that environment and confront embedded ableism and the lack of accessibility. With Hayes, this relationship became one of her self-identifying as a wheelchair user, "The body and the chair began to meld together, changing the dualistic relations in personal navigation from mind-and-body to mind-and-bodychair."[85] For the computer users with disabilities I analyze, this work helps to illuminate the ways some of my actors talk about their relationship with their technology.

The design of technology, though not absolutely deterministic of how people might use it, does offer constraints, both physically and in terms of imagined potential. In his article, "Configuring the User: The Case of Usability Trials," Steve Woolgar uses a metaphor of machine as text in order to explore how users are configured by their

---

83 Michael L. Dorn, "Beyond Nomadism: The Travel Narratives of a 'Cripple,'" in *Places Through the Body,* eds. Heidi J. Nast and Steve Pile (London: Routledge, 2005), 136-152.
84 Ibid., 136.
85 Ibid., 144.

technology.[86] This is not only about how users' actions are delimited by technology design, however: the technology, too, becomes constructed based on its relationship with its users. He argues that: "Configuring occurs in a context where knowledge and expertise about users is socially distributed. As a result of this process, the new machine becomes its relationship with its configured users."[87] Woolgar conducted an ethnography of usability trials at a computer company in order to understand how users—both their identities as people who use a certain computer and in what they then do with the machine—come to be socially constructed. He also seeks to blur the boundaries between machines and users in how they mutually define the boundedness of each other: "The capacity and boundedness of the machine take their sense and meaning from the capacity and boundedness of the user."[88] The boundaries of the machine (the physical case of the computer) came to symbolize the boundaries of the company; users were correctly configured when they did not breach this boundary and access the interior of the machinery in unapproved ways.[89] I utilize this idea of configuring users in understanding the different preferences people with disabilities had for different computers, especially in what uses those computers either provided or blocked access to. I explore these concepts in detail in chapters 3 and 6.

One way that technology configures its users is through the values that come to be embedded in objects during their development. Such values include those relating to the Cold War as Edwards described and human augmentation that Bardini discussed. The computer has developed to include numerous and contradictory moral and political

---

86 Steve Woolgar, "Configuring the User: The Case of Usability Trials," in *A Sociology of Monsters: Essays on Power, Technology and Domination,* ed. John Law (London: Routledge, 1991), 57-99.
87 Ibid., 59.
88 Ibid., 68.
89 Ibid., 79.

values. These values are part of the cultural context that tells users what a technology is to be used for and the potential it might have for other uses. For example, Christopher Kelty explores the history of free software and what it says about the relationship people desire to have with information in *Two Bits: The Cultural Significance of Free Software.*[90] He argues that “Free Software exemplifies a considerable reorientation of knowledge and power in contemporary society—a reorientation of power with respect to the creation, dissemination, and authorization of knowledge in the era of the Internet.”[91] Free software, as a movement, came into being in the late 1990s; built into it and its software output were values of openness, sharing, and collaboration.[92] Kelty utilizes the concept of a recursive public to describe the free software community: a group that is defined by a shared concern for maintaining the means through which they come together as a group. The internet is one site where recursive publics can form, who in turn work to defend the internet as the place which enables their grouping. Kelty describes the values embedded in the internet which encourage such group formation: “Geeks find affinity with one another because they share an abiding moral imagination of the technical infrastructure, the Internet, that has allowed them to develop and maintain this affinity in the first place.”[93] This shared understanding of the values built into the technology of the internet shapes the imagination of users of the technology as to what it is possible to do with it. I analyze such values embedded in the personal computer that made it seem an ideal technology to provide people with disabilities access to social participation.

The values of the personal computer I most closely work with involve it as a

[90] Christopher M. Kelty, *Two Bits: The Cultural Significance of Free Software* (Durham, NC: Duke University Press, 2008).
[91] Ibid., 2.
[92] Ibid., 14-15.
[93] Ibid., 28.

universal technology, capable of being used for any purpose people can imagine, particularly in bringing people together using new forms of communication. The history of the origin of personal computer values is discussed by Fred Turner in *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism.*[94] Turner discusses the influence of the 1960s counterculture, particularly Steward Brand's Whole Earth network, on the development of the personal computer, and the change computer technology underwent from being viewed as industrial and impersonal to a symbol of possible communion and global harmony. Even after the end of the counterculture, this new view of computers persisted: "Two decades after the end of the Vietnam War and the fading of the American counterculture, computers somehow seemed poised to bring to life the countercultural dream of empowered individualism, collaborative community, and spiritual communion."[95] Countercultural values had become embedded into the meaning of the personal computer, mixing with military-industrial culture and cybernetics. I utilize Turner's history of this development of the personal computer as a successor to counterculture attempts to use technology to create new, communal societies. Technology was seen here as tools that allow anyone to build the kind of society they wished; similarly, the personal computer is a universal tool usable for any purpose. With the personal computer, many of its first developers envisioned that it would be a tool of openness guided by imagination, providing users a means to accomplish any task they could devise, once it had been programmed to do so. This value of universality plays into the efforts to make the personal computer accessible to people with disabilities, in that the computer should not

94 Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: The University of Chicago Press, 2006).

95 Ibid., 2.

be limited in who could use it as well as how they chose to do so.

The development of accessibility in technology crystallized in the 1990s into the idea of universal design, found in architecture, industrial design, and computer science. Universal design is both the result of the history I examine and one of the guiding principles that entrenched accessibility into the development of personal computer technology. The guidelines for universal design were codified in 1997 by researchers working for the North Carolina State University Center for Universal Design.[96] These researchers formulated seven principles that would aid developers in designing "products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."[97] The seven principles are:

1) Equitable Use
   The design is useful and marketable to people with diverse abilities.
2) Flexibility in Use
   The design accommodates a wide range of individual preferences and abilities.
3) Simple and Intuitive Use
   Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
4) Perceptible Information
   The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5) Tolerance for Error
   The design minimizes hazards and the adverse consequences of accidental or unintended actions.
6) Low Physical Effort
   The design can be used efficiently and comfortably and with a minimum of fatigue.
7) Size and Space for Approach and Use
   Appropriate size and space is provided for approach, reach, manipulation,

---

96 Bettye Rose Connell et al., *The Principles of Universal Design* (Raleigh: North Carolina State University, Center for Universal Design, 1997). http://www.ncsu.edu/www/ncsu/design/sod5/cud/about_ud/udprinciplestext.htm.

97 Ibid.

and use regardless of user's body size, posture, or mobility.[98]

These universal design principles have been applied and studied in numerous works in architecture and design, as a way to expand the use of the built environment and consumer products to include the needs of more people. Many of these efforts deal with explicitly bringing in people with disabilities as users and to provide ways to comply with legislative requirements of accessibility.[99] The principles, while systematized in the late 1990s, were a part of the development of accessibility throughout the history I tell. They were ideals, emerging from the struggle for civil rights and the values embedded in the computer, that grew and spread through the computer industry, culminating in universal design as an everyday concept.

Universal design provides a method for making the social environment more accessible, by accounting for the diverse needs of people with different bodies and abilities. It changes the understanding of universality, by accommodating the needs of all through an awareness of the differences between people. This perspective blurs any distinction between people with disabilities and those without, by attempting to meet all needs of potential users. As scholars who worked within the social model of disability discussed, disability should be seen as a continuum that describes both an identity and the ways certain people are prevented from full participation in society.

Universal design is also relevant to computer development, as a method to create software and hardware that is usable by as many people as possible. Using a broader

---

98 Ibid.

99 See George A. Covington and Bruce Hannah, *Access by Design* (New York: Van Nostrand Reinhold, 1997); Wm. L. Wilkoff and Laura W. Abed, *Practicing Universal Design: An Interpretation of the ADA* (New York: Van Nostrand Reinhold, 1994); Jon A. Sanford, *Universal Design as a Rehabilitation Strategy* (New York: Springer Publishing Company, 2012); Søren Ginnerup, *Achieving Full Participation Through Universal Design* (Council of Europe Publishing, 2009).

version of universal design called universal usability, the computer scientists in the edited volume, *Universal Usability: Designing Computer Interfaces for Diverse User Populations,* lay out methods of creating user interfaces that meet the needs of diverse users.[100] The editor of the book, Jonathan Lazar, explains that universal usability imbues universal design with values explicitly encouraging user diversity and greater ease of use.[101] In his preface to the book, Ben Schneiderman argues for the business benefits of designing with universal usability:

> The business case for universal usability is increasingly clear: advanced designs expand the audience and enable greater levels of success for all users. For e-commerce the payoff is clear: larger markets and increased sales. For government service and information providers the benefits can be measured in web log statistics which show more unique visitors and page views.

Drawing a comparison with the creation of the curb cut, which I discuss further in chapter 3, Schneiderman argues that increasing usability for people with disabilities also increases usability for other users. By paying attention to users' needs and the details of how they use computer technology, universal usability is a means of finding places where users' understanding of a technology does not fit with the intentions of its design.[102]

Universal design is, in many ways, the outcome of the history I examine. Though it does not exist under that name until the end of my account, the tenets of universal design were developed throughout this history, increasingly affecting the development process in terms of who the imagined user could be and how their needs were met. Universal design defines the imagined user not as the universal or average human, but as an amalgum of all differences between people. Activists and developers argued for the

---

[100] Jonathan Lazar, ed., *Universal Usability: Designing Computer Interfaces for Diverse User Populations* (Chichester, West Sussex: John Wiley & Sons, Ltd, 2007).

[101] Ibid., 1.

[102] Ibid., xi.

business benefits of expanding the userbase by increasing usability and meeting the needs of people with diverse abilities. Latent impulses of increasing usability and attracting a diverse userbase came together in the principles of universal design. I analyze the multiple and sometimes contradictory relationships between usability, accessibility, flexibility, and user-friendliness—finding the places where sometimes one creates another and others where one constructs a barrier to another. No one technology will work for all users; by building the needs of people with disabilities into the design process, by considering a diverse userbase as a value to be embedded in technology, technologies can be developed to better accommodate different needs and enable the potential of computer technologies to edge closer to fulfillment. Accessibility is a means to dissolves boundaries, by allowing anyone access to a technology and its benefits, by accommodating individual needs and allowing greater social participation.

My overall framework combines ideas of these various fields into a set of tools which allow me to consider the different aspects of the development of accessible personal computer technology. Utilizing the social model of disability, I consider the ways that barriers are put into place in society which prevent people with impairments from full social participation. From the history of computers, I draw upon the development of computer technologies within their cultural and political contexts. Science and technology studies provides me with ways of understanding the relationship between technology and its use, the embodied nature of technological use, and the values embedded in technology. Finally, I use the ideals of universal design in examining how certain technological design includes as many users as possible and others exclude some people from the category of the 'normal' user.

1.3 Chapter Outline

I examine the history of accessible personal computer technology development for people with disabilities from the late 1970s through the late 1990s, from the perspective of computer companies—mainly Apple Computer and IBM—and disability activists—mainly the Disabled Children's Computer Group (DCCG) and the Alliance for Technology Access (ATA). These organizations were strongly intertwined throughout their history. Both located in the Bay Area, Apple Computer and the DCCG came together in the mid-1980s to create the ATA, which acted as an umbrella to combine the efforts of dozens of small groups across the country. The ATA began its work from within Apple before separating from the company to become an independent non-profit disability and technology activist group. Apple would continue its ties to these groups into the 1990s. IBM would also play an integral role in providing funding and technological resources to the ATA. Both companies developed their own accessible consumer technologies, while the activist groups promoted the creation of technologies for people with disabilities by these large computer companies and other third-party developers. Most of my primary source materials on the activist groups and Apple come from the archives at the Bancroft Library, at the University of California-Berkeley. For IBM, I draw upon materials provided for me by their corporate archives, as well as a large collection of documents they have digitized and made available on the internet.

I begin this history, in chapter 2, by analyzing two aspects of the historical context within which the development of accessible personal computer technology arose in the early 1980s. First, I analyze federal disability legislation during the late 1960s and 1970s and the change it underwent from a medical model of disability—where disability was a medical problem that was addressed by programs for rehabilitation or charity—to a civil rights model—where people with disabilities were viewed as an oppressed population that needed protections from discrimination and programs to alleviate inequalities. During this shift, and both affected by it and affecting it, people with disabilities began to organize into a social movement, creating their own activist organizations to demand opportunities for full participation in society. Technological accommodations were argued to be part of the solution in enacting equal rights. Second, I examine the use of computer technology by people with disabilities prior to the personal computer. I explore a number of places where people with disabilities interacted with early computer technology: professional organizations for computer programmers and engineers, researchers developing accessible computer technology, and computer companies that employed people with disabilities.

I turn, in chapter 3, to early personal computer technology for people with disabilities. I discuss the innovations and early consumer products created by entrepreneurs and small, third-party companies. One of these companies, Unicorn Engineering, played a significant role in the founding of the local, Berkeley-based disability and technology advocacy group I examine, the Disabled Children's Computer Group. I analyze the personal significance accessible technology held for the founders of this organization and how they joined with other local families to promote the development of more accessible computer technologies and worked to spread knowledge of what was available to people with disabilities. This small group attempted to tackle the problem of a lack of information reaching potential computer users with disabilities by constructing partnerships with technology developers which would allow for a network of information sharing that reached consumers. I also explore early accessibility work at large, mass-market computer companies, namely IBM and Apple Computer, and how the latter began a relationship with the DCCG which would go on to create a significant, national disability organization.

I then examine, in chapter 4, the formation of this group created by Apple and the DCCG, the Alliance for Technology Access—a national umbrella which brought together dozens of local disability and technology advocacy groups like the DCCG under one network of shared resources. I am interested in how the ATA started as a project of corporate philanthropy which then became an independent, nonprofit organization. I analyze the corporate values and environment at Apple during this time that allowed resources to be dedicated to such a project. Jumping into the personal computer market relatively late, IBM more fully enters my story at this time, creating their own successful line of accessible computer products for consumers with disabilities.

Chapter 5 concerns the re-emergence of the disability rights movement during the 1980s and its success at passing new civil rights legislation which had a special relationship with technological accommodations. As the disability rights movement drew national attention to the need for better access to technology for people with disabilities and stricter anti-discrimination rules, two significant pieces of legislation were passed: the Technological Assistance for Individuals with Disabilities Act of 1988 and the Americans with Disabilities Act of 1990. The activist groups I study were involved both in encouraging the passage of this legislation and in reaping some of their benefits. The DCCG and ATA would move on to larger projects after this time, encompassing more people and utilizing more technologies. As a part of the ATA's larger projects, the organization would form a partnership with IBM, as IBM replaced Apple as their chief corporate sponsor.

In chapter 6, I end my history of accessible personal computer technologies with a focus on accessibility and computer software. I discuss one of the final, major shifts in personal computer technology: the change from text-based interfaces to graphical user interfaces. I analyze what this technological change involved and how it impacted users, both positively and negatively. In particular, blind users faced significant difficulties in trying to find a technological solution to the barriers this new standard created. I also examine another example of accessibility in software, involving a partnership between the ATA and Brøderbund Software, during the 1990s. Brøderbund both offered up their own products for accessibility evaluation by the ATA and encouraged other software producers to increase the accessibility of their products. I then conclude with a discussion of changes that took place within both my activist groups and Apple Computer, as accessibility became writ into the development of personal computers in some ways and very much was not in others.

Raymond Kurzweil bookends my work; I analyze his vision of the future relationship between bodies and technologies in my conclusion, alongside a documentary on assistive technologies and people with disabilities. I use these two different perspectives to reflect upon the history I have examined. I find the development of accessible personal computer technologies to be a matter of negotiation and feedback between developers, activists, and users, all of whom came together in attempting to fulfill the promise that the technology holds for enacting civil rights for people with disabilities and creating more usable, flexible technologies which provide people with new kinds of abilities and sites of social interaction.

Chapter 2

Disability Rights and Technology before the Personal Computer

There are two significant aspects of the history of people with disabilities and computer technology that occurred prior to the invention of the personal computer. The first is disability rights legislation which, during the 1960s and 1970s, started to offer people with disabilities the promise of equal rights, enacted through technological accommodations. The second is the use of earlier computer technology by people with disabilities, both professionally and as research subjects. In the following chapters I will show how these two parts came together in the form of the personal computer, as a technology that could provide users with new abilities and grant access to new forms of social participation. In analyzing these two sites, I introduce five historical themes: 1. the shift in disability rights from a paternalistic, caretaker model to a civil rights-based model, 2. the concomitant need for technological accommodations in order for people with disabilities to achieve equal rights, 3. the idea of the computer as a universalizing technology, a tool for anyone, for any purpose, 4. the view of the computer as a technology of augmentation, which allows people to expand their cognitive abilities beyond the limits imposed by the body, and 5. the lived reality of different practices of using a computer by people with different bodies.

Using the above five themes, I explore a number of significant pieces of legislation and challenges in the courts regarding disability rights. I begin with the history of the rights of people with disabilities in the late nineteenth and early twentieth centuries, prior to civil rights legislation. I then trace the development of disability rights through notable federal laws that succeeded in establishing enforceable rights, from the Architectural Barriers Act of 1968, to the Rehabilitation Act of 1973 and the creation of its regulations, and finally the Education for All Handicapped Children Act of 1975.[103]

I next turn to an examination of disability activism and accessible personal computer technologies from the perspective of the computer industry and professional organizations. I begin with a discussion of blind computer programmers during the 1970s and the technological accommodations which allowed them to perform their jobs. I examine a professional organization that focused on promoting the employment of disabled computer professionals and disseminating information on technologies that would benefit people with disabilities. I then look at one of the technologies this organization helped to promote—computerized conferencing—and the research into it which targeted people with disabilities. Computerized Conferencing demonstrates both the potential impact personal computer technology can have on users with disabilities and the role in development played by considering people with disabilities as intended users. Finally, I move more directly within the computer industry to discuss accessibility work and the training of people with disabilities done by IBM prior to the advent of the personal computer.

[103] I primarily draw on the work of four scholars in my analysis of disability rights in the United States: Joseph P. Shapiro, *No Pity: People with Disabilities Forging a New Civil Rights Movement (*New York: Three Rivers Press, 1994). Richard K. Scotch, *From Good Will to Civil Rights: Transforming Federal Disability Policy* (Philadelphia: Temple University Press, 1984). Kent Hull, *The Rights of Physically Disabled People* (New York: Avon Books, 1979). Claire H. Liachowitz, *Disability as a Social Construct: Legislative Roots* (Philadelphia: University of Pennsylvania Press, 1988).

2.1 Disability Rights Legislation and Enforcement

The history of disability rights tells of a transition from a caretaker model of society looking after those unable to care for themselves to a fight for the acquisition of civil rights and equal participation in society through technological accommodations. Prior to civil rights legislation in the 1960s and 1970s, disability legislation was concerned with setting up and funding programs and services: vocational rehabilitation, federally funded institutions and schools, and medical care. These laws were part of models of disability that involved taking care of those who were seen to be unable to contribute to society and making people who had the potential to be useful into contributors to society. According to Richard K. Scotch, from the late nineteenth century and into the Progressive Era, people with disabilities were seen to be part of the "deserving poor," who were dependent on society for their well-being, as a result of circumstances beyond their control.[104] People with disabilities were not viewed as capable of independence and self-sufficiency; they were a burden that able-bodied society should carry, through the work of charities. There was little federal involvement in programs for disabled people during the last half of the nineteenth century. Joseph P. Shapiro attributes this to President Pierce's veto, in 1854, of the first bill to pass Congress that would have provided federal funding for institutions for the deaf, dumb, blind, and mentally ill. The President's veto set a precedent of federal government staying out of disability concerns until the twentieth century.[105]

Legislation concerned with people with disabilities in the twentieth century was enacted as a response to three major factors that enlarged the disabled population: war,

---

[104] Scotch, *From Good Will to Civil Rights,* 9.
[105] Shapiro, *No Pity,* 59-60.

industry, and medical advances. Disability legislation began to focus on ways to turn people with disabilities into productive members of society. Vocational rehabilitation programs in the early twentieth century were created as a response to the growing disabled population created by the World Wars by providing services for disabled veterans to enter the workplace. The Veterans Bureau was established between the wars, with the first Veterans Administration hospitals opening in 1922. Claire H. Liachowitz argues that these programs solved the problem of showing gratitude to veterans for military service; but, unlike previous methods of direct compensation, in a way that also served the nation's welfare by creating workers who could contribute to society.[106] Industrial accidents, combined with improvements in medicine that allowed people with disabilities to live longer, also contributed to a growing disabled population. In 1920, the Smith-Fess Act extended vocational training programs to include all disabled civilians who could potentially work.[107] Vocational rehabilitation programs continued to expand through the mid-twentieth century, increasing their resources and encompassing more people. Although people with disabilities were seen as dependent on these vocational rehabilitation services, they were also capable of easing some of the burden they placed on society by contributing to the workforce. However, there were no requirements that employers treat employees with disabilities equally or that they provide accommodations for them. Disability legislation and programs prior to World War II mostly came about as a result of governmental or charitable group action. Post-World War II, the origins of the later disability rights movement and disability activist groups arose among parents of children with disabilities. As medical advances increasingly allowed children to survive

---

[106] Liachowitz, *Disability as a Social Construct,* 40.
[107] Scotch, *From Good Will to Civil Rights,* 20.

disabilities which had previously been fatal, a growing parents' movement sought support and protection through the creation of groups such as the United Cerebral Palsy Association, formed in 1948, and the Muscular Dystrophy Association, formed in 1950.[108]

It was not until the second half of the twentieth century that activists would fight to protect the civil rights of people with disabilities in American society, by calling for technological accommodations that would allow people with disabilities to participate in society. However, almost a century earlier, a lawsuit anticipated the types of arguments disability rights groups would make in the mid-twentieth century. In the 1870 case *Sleeper v. Sandown,* David T. Sleeper sued the town of Sandown, New Hampshire for failing to maintain a bridge railing, which caused him to fall off the bridge. Sleeper accused the town of negligence and the jury sided with him. The town appealed to the state Supreme Court, arguing that Sleeper was the negligent party, because he had been traveling alone despite the fact that he was blind. The court again sided with Sleeper, concluding that while a blind person must be more cautious than a sighted person, he had the same right to walk along the roadway as anyone and to assume a bridge railing would be in good repair.[109] The town of Sandown was responsible for maintaining the safety railing that would allow a blind person to use the public roadway independently. In this case, society is obligated to provide accommodations that would allow people with disabilities to move about, the same as anyone else. This could not be anything other than a local court decision, however, as there existed no legislative infrastructure to require technological accommodations for people with disabilities or to guarantee their

[108] Shapiro, *No Pity,* 64.
[109] Ibid., 17-18.

participation in society. It was not until almost a century later that civil rights for people with disabilities would become a federal issue.

A marked shift in disability rights legislation began in the 1960s with the expansion of the idea of civil rights to more and more groups of people, across differences in race, gender, sexuality, and eventually, disability. The emergence of identity politics brought people together into communities within these social categories, giving new strength to struggles for equality. Landmark bills in disability legislation began to grant equal rights and anti-discrimination protections to people with disabilities. Programs of integration required the inclusion of people with disabilities alongside everyone else—in education, employment, and public services—instead of segregating them.[110] Technology played an essential role in procuring rights for people with disabilities. As disability legislation moved to a rights-based model in the late 1960s, enforcement was enacted through technologies of accommodation. Accessibility to buildings and public transportation required technologies that would allow people access, regardless of disability. In order to acquire equal rights, people with disabilities required society to be made physically accessible. In legislation of the 1970s, prohibitions against discrimination in education and employment made special accommodations for people with disabilities a requirement for programs receiving federal funding.

2.1.1 Architectural Barriers Act of 1968

The Architectural Barriers Act of 1968 (ABA) was one of the first pieces of federal disability rights legislation to protect all people with disabilities; it did so by

---

[110] Scotch, *From Good Will to Civil Rights,* 10.

requiring technological changes to the built environment to accommodate the needs of all people. The purpose of the ABA was: "To insure that certain buildings financed with Federal funds are so designed and constructed as to be accessible to the physically disabled."[111] It covered all buildings constructed, leased, or financed by the federal government after August 12, 1968. The act itself set no standards for how accessibility was to be achieved, instead allocating the responsibility for different kinds of buildings to their respective federal agencies: the Department of Housing and Urban Development, the Defense Department, and the Postal Service—all under the oversight of the Department of Health, Education, and Welfare.

The move toward barrier-free architecture was supported by vocational rehabilitation programs, with the understanding that providing training for employment meant little if the buildings that housed jobs were inaccessible to people with disabilities.[112] Kent Hull succinctly describes the importance of the problem of architectural barriers for all people with disabilities: "For many handicapped persons—not just those with ambulatory handicaps, but also blind persons and deaf persons (who face barriers when appropriate stimuli such as brailled elevator buttons and visual public announcement systems are absent)—the existence of architectural barriers is a fact that cannot be discarded by public declarations in favor of equality for handicapped persons."[113] The physical reality of architectural barriers, in other words, makes participation in society a continuous difficulty for people with disabilities. The ABA demonstrates the shift that began in the 1960s when the possibility of equal participation

---

[111] Architectural Barriers Act of 1968, 42 U.S.C. § 4151 (1968).
[112] Scotch, *From Good Will to Civil Rights,* 30.
[113] Hull, *The Rights of Physically Disabled People,* 65-66.

in society became something which could be seen as a right of people with disabilities. However, removing architectural barriers had to be explicitly dealt with through enforceable legislation; attempts to encourage the public to remove barriers through education and awareness of the problems they caused failed.[114] Yet, even with federal legislation, compliance was not assured and did not always win out over economic concerns. While people with disabilities became part of the expansion of civil rights in the 1960s, unlike with other groups of people, anti-discrimination cannot be enacted through legislation alone; the lack of accessibility in public spaces can only be remedied with significant investment in infrastructural changes.

As an example of the kinds of battles fought over the requirement of accessibility in public buildings, in 1970, the ABA was amended to include the Washington, D.C. Metro system then under construction. Accessibility to the Metro had to be enforced through a 1972 lawsuit brought against the Washington Metropolitan Area Transit Authority by a civil rights organization, the Washington Urban League, and focused on issues of accessibility mainly at the Gallery Place station. As the Metro became operational in 1976, Gallery Place station was still closed due to lack of accessibility. Local businesses requested that the federal court order the opening of the station, as other nearby stations were taking customers away from them. The court refused, appearing to choose to defend the rights of people with disabilities and enforce existing legislation over the economic concerns of local business; the judge explained the necessity of forced compliance with the ABA:

> There is simply no other way apparent to the Court to ensure that the defendant, once and for all, will accept and carry out its obligations under the Act, not only

[114] Ibid., 67.

> with regard to Gallery Place but with regard to the remainder of the stations in its system. To now set a precedent to the contrary would in this Court's view lead to repeated excuses by defendant that elevator construction has been delayed for any number of facially valid reasons, e.g., lack of funds, construction delays, etc., with a concomitant request to operate the station in violation of the law.[115]

As the court's decision demonstrates, technological accommodations that would allow for people with disabilities to fully participate in society could not be accomplished without strict enforcement. However, though the court seemed to side with the rights of people with disabilities, a loophole in the legislation itself countered this rhetoric of enforcement. The ABA contained a clause allowing for its standards to be modified or waived on a case by case basis when such allowance was "clearly necessary," which the Transit Authority appealed to and was granted a waiver under. Though the station was made accessible only two years later, the power and enforceability of the ABA was clearly not absolute, as, in this example, economic concerns were sometimes allowed to trump accessibility for people with disabilities. The Transit Authority was able to comply with the regulations within a couple of years and local businesses were satisfied, at the cost of some people being blocked for a time from traveling via Gallery Place.

2.1.2 Section 504 of the Rehabilitation Act of 1973

Where the ABA only concerned itself with a specific form of lack of access for people with disabilities, the next major civil rights legislation that was passed had a far broader reach. Arguably the most important piece of disability rights legislation prior to the Americans with Disabilities Act of 1990, the Rehabilitation Act of 1973 was signed into law by President Nixon on September 26, 1973; as with the ABA however, it too

---

[115] Quoted in ibid., 79.

faced problems of lack of enforcement. This law was intended to continue the vocational rehabilitation program established by the Smith-Fess Act of 1920, which provided federal funds to the states for vocational services for disabled citizens. The Rehabilitation Act was not in any way intended as ground-breaking civil rights legislation; it was a routine continuation of a previous law. However, at the very end of the act is Section 504: "No otherwise handicapped individual in the United States, as defined in section 7(6), shall, solely by reason of his handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."[116] Section 504 was the first piece of federal legislation to grant people with disabilities the same protections and rights as anyone else. The passage stands alone, with no details of how it should be implemented, who would be responsible for its enforcement, or any estimates of the cost of its implementation.

Sociologist Richard K. Scotch traces the development of Section 504 and its regulations in his book, *From Good Will to Civil Rights: Transforming Federal Disability Policy*. He explains the lack of any implementation rules for Section 504: "Section 504 was apparently a routine inclusion, a noncontroversial bow toward equal access with no significant commitment of federal authority."[117] The story of how Section 504 came about is not one of deliberate, pre-planning by legislators. It was the staff of the Congressional committee charged with drafting the Rehabilitation Act of 1973 who tacked Section 504 onto the end, deliberately mimicking the language of Title VI of the Civil Rights Act of 1964.[118] Staff members felt that without a provision to prohibit discrimination, people

---

[116] Rehabilitation Act of 1973. Pub. L. No. 93-112, 87 Stat. 394, 29 (1973).
[117] Scotch, *From Good Will to Civil Rights,* 5.
[118] Ibid., 52.

with disabilities coming out of the vocational programs sponsored by the Rehabilitation Act would have trouble finding employment.[119] Scotch describes the motives behind and power of these staff members to write such an important piece of civil rights legislation:

> The addition of Section 504 to the Rehabilitation Act of 1973, however, was not the result of the efforts of a social movement or of traditional interest group politics but rather the result of a spontaneous impulse by a group of Senate aides who had little experience with or knowledge about the problem of discrimination against disabled people. Seeing an opportunity in a fairly standard piece of legislation, these Senate staff members sought to promote disabled people's participation in employment and other activities by prohibiting discrimination on the basis of handicap in federally supported programs. Because of their strategic role in the legislative process, they were able to do so essentially on their own initiative.[120]

These staff members were in a position where they could not only speak for the welfare of people with disabilities, but possessed the power to create actual change. Their view toward people with disabilities was that they deserved the same rights as others to participate in society. The work of these staff members went unchallenged; once the Rehabilitation Act reached Congress, there was no debate about Section 504 or a fight to get it passed. At the time, Congress did not note its potential significance.

Though the law was passed without the efforts of a disability rights movement, public disability activism became involved in the history of Section 504 when the regulations were drawn up. The task of doing so was assigned to the Department of Health, Education, and Welfare's (HEW) Office of Civil Rights (OCR). The choice of this assignment was a major reason for the efficacy of Section 504's enforcement, as the OCR was committed to social change from within the government.[121] The OCR also had experience developing regulations for civil rights legislation, as they had worked on both

---

119 Ibid., 51.
120 Ibid., 139.
121 Ibid., 60.

Title VI of the Civil Rights Act and Title IX of the Education Amendments of 1972. Even so, it took until 1977 for the publication of the final regulations for Section 504. When the OCR began drafting regulations, they called on people with disabilities to provide their expertise, but these meetings were informal and about information, not activism.[122] Individuals with disabilities were contacted through personal connections, not through formal, disability advocacy organizations. Disability organizations were not aware of Section 504 or the OCR's regulations until the spring of 1975, as the initial draft of regulations was being finished.[123] Until this point, Section 504 and its regulations were primarily developed by people who were not themselves disabled speaking for the rights of people with disabilities. Disability activists became more prominent in fighting for Section 504 as the OCR failed to actually publish their final regulations. The American Coalition of Citizens with Disabilities (ACCD), just previously formed in 1974 and led by prominent deaf activist and writer Frank G. Bowe, held demonstrations throughout 1976, demanding that the regulations be published without being watered down. The OCR waffled and published their draft as a Notice of Intent to Publish Proposed Rules, in the spring, instead of as a finalized document.[124] In response, demonstrations organized by the ACCD continued into 1977, at HEW offices across the country. A sit-in in San Francisco led by Judy Heumann of Berkeley's Center for Independent Living lasted twenty-five days and received national attention. Joseph Shapiro attributes part of the success to the atmosphere of the Bay Area as a center of activism. The sit-in protesters—more than 120 people at the peak—received support from other activist groups, including

[122] Ibid., 79.
[123] Ibid., 84.
[124] Ibid., 93.

the gay rights Butterfly Brigade and the Black Panthers; even local government officials supported the disability rights activists.[125] The protesters won their desired result, and on April 28 the Section 504 regulations were finally signed.

The final Office of Civil Rights regulations for Section 504 were published in the *Federal Register* on May 4, 1977 and attest to its significance in the history of disability rights legislation: "Section 504 thus represents the first Federal civil rights law protecting the rights of handicapped persons and reflects a national commitment to end discrimination on the basis of handicap."[126] Direct reference is made to the fact that Section 504 mimics the language of Title VI and Title IX. Making more specific the broad language of Section 504, the regulations are divided into seven parts: General Provisions; Employment Practices; Program Accessibility; Preschool, Elementary, and Secondary Education; Postsecondary Education; Health, Welfare, and Social Services; and Procedures.[127] The basic requirements of the regulations are that employers must make "reasonable accommodations" for applicants and employees, unless this would cause "undue hardship." For any providers of services, existing and new facilities must be made accessible to people with disabilities and any programs must be nondiscriminatory in their selection processes.

As with the ABA, there is an exception built into the Section 504 regulations, concerning to economic costs to employers; if accommodations were determined to be unaffordable, then employers could take into account an employee's disability in deciding to retain them. Otherwise, however, the regulations are intended to provide access for

---

125 Shapiro, *No Pity,* 67.
126 Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance. 42 Fed. Reg. 22676 (May 4, 1977).
127 Ibid., 22677-22678.

people with disabilities in many parts of public life. The introduction of the regulations gives justification for creating accommodations, on the grounds that a lack of discrimination alone is inadequate to enacting equal rights:

> But eliminating such gross exclusions and denials of equal treatment is not sufficient to assure genuine equal opportunity. In drafting a regulation to prohibit exclusion and discrimination, it became clear that different or special treatment of handicapped persons, because of their handicaps, may be necessary in a number of contexts in order to ensure equal opportunity. Thus, for example, it is meaningless to 'admit' a handicapped person in a wheelchair to a program if the program is offered only on the third floor of a walk-up building. Nor is one providing equal educational opportunity to a deaf child by admitting him or her to a classroom but providing no means of the child to understand the teacher or receive instruction.[128]

A civil rights-based model for people with disabilities could not be accomplished by only prohibiting discrimination. Buildings, workplaces, and educational institutions would have to be physically altered and specialized tools be provided, in order for people with disabilities to fully participate in society. The costs of such accommodations for recipients was acknowledged, but the regulations provided no outright exemption from the enforcement of Section 504. Scotch argues that this refusal to cave to economic concerns, other than in extreme circumstances, was a part of OCR thinking: "The view seemed also to be based on ideological disregard for problems involved in doing the right thing."[129]

The Section 504 regulations were not the only important legislation passed during this time to affect the lives of people with disabilities. Passage of the Rehabilitation Act of 1974 significantly changed the federal definition of "handicapped" which would be later reflected in the heart of the regulations. The original 1973 Act defined a

---

[128] Ibid., 22676.

[129] Scotch, *From Good Will to Civil Rights,* 76.

"handicapped individual" as someone who: "(A) has a physical or mental disability which for such individual constitutes or results in a substantial handicap to employment and (B) can reasonably be expected to benefit in terms of employability from vocational Rehabilitation services provided pursuant to titles I and III of this Act."[130] The 1974 Act significantly broadened the definition to anyone who: "(i) has a physical or mental impairment which substantially limits one or more major life activities, (ii) has a record of such an impairment, or (iii) is regarded as having such an impairment." Here, "major life activities" are defined as: "functions such as caring for one's self, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning, and working."[131] These definitions expanded the previous focus on difficulties in employment as the defining characteristic of disability to now include other essential aspects of a person's life. The view of aiding people with disabilities by helping them relieve the burden they imposed on society through employment was now entirely changed to an issue of civil rights and equal participation in society.

2.1.3 Education for All Handicapped Children Act of 1975

Furthering the move toward legal civil rights for people with disabilities, the next law I discuss specifically tackled issues of equal access to eduction. Requiring that states grant children with disabilities the same rights as non-disabled children, the Education for All Handicapped Children Act of 1975 (EAHC) mandated the inclusion of children with disabilities in public education. This law not only dramatically changed the structure of the public school system, but also created a new generation of highly educated people

---

[130] Rehabilitation Act of 1973. Pub. L. No. 93-112, 87 Stat. 394, 29 (1973).
[131] Rehabilitation Act Amendments of 1974, Pub. L. No. 93-516, 88 Stat. 1617 (1974).

with disabilities who grew up with expectations of fuller participation in society. The EAHC provided for federal funding to the states for education, so long as certain rules were followed—namely, that handicapped children be granted "free appropriate public education."[132] Children with disabilities, for the first time, were required to receive the same level of education as other children.[133] The EAHC had much in common with Section 504 and repeated some of the same requirements regarding K-12 education, although the EAHC was more specific in its instruction.

The impact of the Education for All Handicapped Children Act would become obvious more than a decade later, as the first students who went through the public school system under its requirements began to graduate from high school. Shapiro marks this as a turning point in the history of disability rights. As these young adults with disabilities graduated into a world where they found fewer protections and rights than they had had in school, Shapiro argues that a new disability rights movement began to form under a stronger understanding of disability as a social identity and community of people. It was these beneficiaries of legislation in the 1970s who would go on to fight for the Americans with Disabilities Act of 1990.[134]

2.1.4 Challenges to the Enforcement of Disability Rights

While the disability rights movement would resurge to new strength in the late 1980s, until then it faced a period of challenges and losses to disability rights. Even at its strongest, in the mid-1970s, the rights of people with disabilities were never completely

---

[132] Education for All Handicapped Children Act of 1975, Pub. L. No. 94-142 (1975).
[133] Shapiro, *No Pity,* 70.
[134] Ibid., 73.

assured in the courts. This situation was exemplified by *Lloyd v. Illinois Regional Transportation Authority,* a lawsuit brought by people with disabilities against the public transportation services in the Chicago area, citing the inaccessibility of the transit system for people with mobility impairments. In this lawsuit, the courts showed continued reluctance to treat discrimination against disabled people as an enforceable issue:

> As late as 1976, a federal district judge held that one of the major federal statutes prohibiting discrimination against handicapped persons was merely 'precatory,' a legal term to describe language which entreats, requests, and recommends, as distinct from language which directs and commands. The essence of this judicial holding was that the long-awaited civil rights provision had no teeth in it.[135]

Though another court overturned this decision, the shaky ground on which the enforcement of disability rights law stood is evident.

Challenges to the enforcement of Section 504 continued with another landmark case in 1976, *Davis v. Southeastern Community College*. Frances Davis, a licensed practical nurse for almost ten years, sued a local college for refusing her admittance into their registered nurse program on the basis of her hearing impairment. The court ruled against her, claiming she could not satisfy the duties of an RN, notably in emergency situations. Hull argues that the court misunderstood both the job requirements of an RN and Davis's proven ability to work as an LPN with their decision.[136] Davis appealed the ruling and the Fourth Circuit Court of Appeals sided with her, concluding that the college could not take her disability into account when deciding admission. The college's challenge to this ruling was held before the Supreme Court, who overturned the Court of Appeals. They judged that the nursing program could consider physical qualifications alongside academic and technical abilities and that the college was not obligated to adjust

---

135 Hull, *The Rights of Physically Disabled People,* 22.
136 Ibid., 162.

their curriculum to create a track that would work for Davis.[137] Activists criticized the ruling for both failing to defend Davis and for the lack of any definition by the court as to the limits of their ruling and how it should apply in similar cases, leaving enforcement of Section 504 open to other challenges. Section 504 was not strong enough on its own to guarantee people with disabilities equal rights and protections against discrimination.

In many ways, the influence of the disability rights movement faded during the decade following 1978. Attempts by activists to extend Title VII of the Civil Rights to include discrimination on the basis of disability in all types of employment failed to find Congressional supporters. There were few legislative advances for disability rights after the publication of the Section 504 regulations.[138] Hull feared that, at the time his book went to press in 1979, there was both inadequate enforcement of existing laws and threats to ground already won for disability rights.[139] Shapiro argues that part of the reason for this lack of progress was geographical; other areas of the country lacked the activist culture of the Bay Area and feared the costs associated with accessibility. Arguments against the costs of enforcing Section 504 were reported in newspapers throughout the country. Unlike extensions of civil rights to other non-disabled groups, anti-discrimination for people with disabilities cost money.[140] The disability rights movement would not regain its strength until the late 1980s and the move to pass the Americans with Disabilities Act.

---

[137] Ibid., 164.
[138] Scotch, *From Good Will to Civil Rights,* 164.
[139] Hull, *The Rights of Physically Disabled People,* 14.
[140] Shapiro, *No Pity,* 70-71.

2.2 Computer Technology and People with Disabilities

The second historical context I discuss prior to the development of the personal computer involves the use of previous computer technologies by people with disabilities. The main ways people with disabilities interacted with computer technology, during this time, was through professional careers involving computers and computer science research. Even with this earlier technology, users and developers realized the potential computers held to change what it means to be disabled, as people with different kinds of disabilities found employment using the computer with technological accommodations or were the subjects of cutting-edge computer research. Disability access and computer technology became experimental sites for each other, as new ideas of usability and imagined users were conceived. I examine accessible computer technology and people with disabilities in four aspects of the computer industry: blind computer professionals, an organization for computer professionals, computer science research, and a large-scale computer technology company. While covering computer technology throughout the twentieth century, I mainly focus on technologies and people with disabilities during the 1960s and 1970s, leading up to the development of the personal computer in the late 1970s. During this time, accessibility was needed for computer professionals with disabilities to perform their jobs. In addition, the potential of the computer to one day be a technology that could change people's lives for the better was anticipated; in particular, computer technologists and researchers foresaw its possible use to benefit people with disabilities.

2.2.1 Blind Computer Programmers in the 1960s and 1970s

There existed a brief period during the 1960s and 1970s when the state of computer technology and views on the capabilities of people with disabilities created a situation where blind people were encouraged to become computer programmers. During the late 1960s, the Association for Computing Machinery (ACM)—the largest professional organization in the world for people who work on computers—ran a Committee on Professional Activities of the Blind. The committee started in 1964, published a newsletter for four years and organized a conference in 1969. In an article published by the ACM in 1964, the chair of the newly formed committee, Theodor D. Sterling, and his co-authors described the possibilities for blind people working as computer programmers.[141] Addressing employers more than potential blind programmers themselves, the authors argued that blind people were not only capable of being programmers, but were particularly well-suited to the job; this could benefit employers, as there was a shortage of programmers at this time. The argument put forward by the authors was that blind people might be inherently skilled at programming because navigating an environment non-visually requires an understanding of space and organization that is applicable to understanding the layout and operation of large, complex programs.[142]

In addition to these abilities of "orientation," blind people required few, inexpensive technological accommodations to work in computer programming. First, for program preparation, a blind person was unlikely to need to punch his or her own cards

[141] Theodor D. Sterling et al., "Professional Computer Work for the Blind," *Communications of the ACM* 7, no. 4 (1964): 228-251.
[142] Ibid., 228.

for the program, as this was a job usually done by a clerk, not a programmer. Computer work was organized during the 1960s with a programmer designing programs and writing out instructions, which a clerk then translated onto punchcards that were read by a mainframe computer; the clerk performed the actual operation of the computer. In order to provide the clerk with the program, a blind person could either type in and print out the program (a slower method) or, using special paper with a diagram of a punch card embossed onto it, the programmer could feel where instructions should be placed on the punchcard and write them in (a more expensive method). The authors argued in favor of the latter method, as working best, in spite of the additional cost of specialized paper.[143] Second, with program assembly, the programmer would need to read printouts of program listings and memory dumps. These could be translated into braille and printed using a standard printer, with the only additional cost being the braille translation software.[144] Third, during program execution and debugging, the authors discussed two options for the blind programmer. For simple programs, the programmer could print memory dumps in braille and read them to find errors. For more complex programs, the programmer would need to read the position of various knobs and buttons on the computer console (which a blind person could do by feel) and see the activation of lights. The authors suggested that a blind programmer could use an inexpensive "heat sensitive probe which translates the light into sound" in order to hear the console lights.[145] Finally, a blind programmer would occasionally need to read a punch card itself, which could be

---

143 Ibid.

144 This method of printing braille worked by the printer repeatedly printing a period in the same spot. This caused the paper to emboss the period on the back of the paper. This process would not create as permanent of braille as an actually mechanical embosser could, but would stay readable for some time if stored carefully.

145 Ibid., 229.

done via a special mechanical reader that allowed the user to feel and interpret the card.[146] All of these technologies were listed as relatively inexpensive and easy to use. This accommodation of the needs of blind programmers anticipates the coming civil rights model of disability, by showing that participation is possible through technological accommodation and benefits both employees and employers.

In other ways, however, the treatment of these early blind programmers fails to enact full civil rights by still viewing disability as a problem the individual has, which must be fixed enough to allow them to participate, but otherwise not get in the way of their job. In 1966, the ACM's Committee on Professional Activities of the Blind published a book on *The Selection, Training, and Placement of Blind Computer Programmers*.[147] In addition to repeating similar technical information found in Sterling's article two years previously, this short manual also demonstrates the discriminatory and condescending work environment blind people faced in the late 1960s. Prior to any legislation providing civil rights for people with disabilities, the perspective this book reveals is one of responsibility falling solely on the blind person to fit into a sighted workplace: "The blind candidate for employment has to satisfy the manager of the center that his handicap will not interfere in the smooth performance of his own work or that of his co-workers."[148] Blind employees had to ensure that they did not get in the way of their sighted colleagues with any accommodations they might need to perform their job or move about the workplace: "It is the responsibility of each person to make sure that the use of these special devices and aids or dogs does not impinge in any way on the rights or

---

146 Ibid., 230.

147 Committee on Professional Activities of the Blind, *The Selection, Training, and Placement of Blind Computer Programmers* (n.p.: Association for Computing Machinery, 1966).

148 Ibid., 36.

interfere with the convenience or safety of his co-workers."[149] This ACM publication intended to encourage blind computer programmers to join the profession, but the tone of the book makes it clear that, in some ways, society was not ready for people with disabilities to publicly take part in everyday activities. Blindness was a disability that would not necessarily prevent employment in the field of programming, but, prior to the emergence of disability as a civil rights issue and social movement, it was something that the blind person was responsible for masking around sighted people: "He should have successfully resolved any problems related to his blindness which might stand in the way of his training or employment. Unpleasant mannerisms sometimes associated with blindness must be corrected if he is to secure and hold gainful employment."[150] If blind programmers could accommodate themselves to the established operation of sighted workplaces—and not appear overtly disabled—then they could find a place in a technical field where the kind of work and tools existed that required few alterations for a blind worker.

While punchcard computing remained the standard, the technology that blind programmers used changed little. A newsletter run by the successor to the ACM Committee on Professional Activities of the Blind printed the results of a survey, in 1973, that had previously been given to blind programmers.[151] The survey results do not indicate how many people responded,[152] but do describe what technologies blind programmers were using and other aspects of their work. Technologies used included: braille writers, tape recorders, typewriters, punch card readers, braille software, and other

[149] Ibid., 7.
[150] Ibid., 15. This aside is a part of a section on professional behavior for the potential employee.
[151] Gordon Cummings, "Blind Programmer Questionnaire," *SIGCAPH Newsletter* no. 8 (1973): 4-13.
[152] Two questions listing individual responses had forty-seven and forty different answers, respectively, implying at least that many respondents.

related tools. A second question asked respondents what technology they wish existed; answers mostly involved improvements on current technology, such as faster conversion of print to braille, faster punchcard readers, and ways to combine various technologies together so that programmers would not have to use multiple tools. Ninety percent of respondents stated that a faster punchcard reader would be valuable to them, indicating a shift in the profession from the 1960s when the ACM described programming as a job that required little time spent reading actual punchcards. A more general question asked what other developments blind programmers would like to see in their occupations. Many responses mentioned improved education and training for blind people, as well as the education of employers and sighted programmers about blind programmers' abilities in order to make gaining employment easier. Respondents also desired greater availability of computer manuals in braille.

The trend of employing blind people as computer programmers dropped off in the 1970s, due to changes in computer technologies and workflow operation. As punchcard readers transformed into keyboard terminals, blind people were no longer faced with easy adaptive devices to create and read programs. Increasingly, programmers worked on computers themselves—without going through the intermediary of a clerk. Instead of reading output through a printout or lights on a display, programmers needed to control a computer through the use of a monitor screen. Different kinds of assistive technologies, such as screen readers, would be needed for blind people to operate these new computer technologies. The shift from punchcards to terminal computing is an example of the kind of shift in standardization which can leave people with certain kinds of disabilities behind; where the previous technology worked with the needs of blind people, via simple accommodations, the new computer paradigm excluded blind people as it operated counter to their needs. This early example of a group of people with disabilities functioning as computer users demonstrates the slow drive toward integration, where blind people could be accommodated and participate, but were also required to hide their disability as much as possible.

2.2.2 Special Interest Group on Computers and the Physically Handicapped

As the concept of integration became more normalized, the attention on computer technology for people with disabilities spread. For the ACM Committee for Professional Activities of the Blind, this occurred with a broadening of focus to include other people with disabilities, as the committee transformed itself into SIGCAPH (Special Interest Group on Computers and the Physically Handicapped[153]). Special Interest Groups (SIGs) are a way for ACM members with common interests to connect and communicate with each other; the groups publish newsletters for their members and often run their own conferences and workshops. SIGCAPH was created in 1971 as a way for computer professionals with disabilities and people who worked with and supported them to communicate with each other about current research and technological developments; it was divided into sections on the blind, deaf, and motor impaired. It was very small for two decades, often the smallest of all the ACM SIGs, sometimes with fewer than three hundred members.

Since its inception, SIGCAPH experienced periods of enthusiasm and productivity, followed by struggles to publish newsletters on time or fill necessary officer

153 SIGCAPH was renamed to the Special Interest Group on Accessible Computing (SIGACCESS) in 2003.

positions. Difficulty convincing members to volunteer as officers or contribute materials to the newsletter plagued SIGCAPH for twenty years. Individuals kept the group alive during its downtimes; various chairpersons and newsletter editors often contributed much of the newsletter materials and stayed in office for the maximum time allowed by the ACM. Even when early personal computer development started to kick off, SIGCAPH was not in a position to cover the new advances to computer technology. It is unclear why SIGCAPH members were mostly apathetic about the state of the group for so long, though lack of a sense of community seemed to play some role. Strong, motivated individuals were able to create momentary enthusiasm, but that tended to lapse after only a few months.

SIGCAPH was not formalized as an activist group but as a professional organization, and, as the computer was some years from being a consumer technology, these were not public users. Yet the group provided similar functions for its members as the disability and computer activist groups that later emerged in the 1980s. SIGCAPH offered a way for people interested in disabilities and computers to communicate with each other and learn about technological developments in both the newsletter and conference presentations. They also worked to promote the education and hiring of computer professionals with disabilities. The founding goals of SIGCAPH, in 1971, were:

> 1.To promote the professional interests of computing personnel with physical disabilities.
> 2. To promote the application of computing and information technology toward solutions of disability problems.
> 3. To perform a public education function in support of computing careers for suitably trained blind, deaf or motor impaired persons.[154]

[154] Lois Leffler, ed., "SIG/SIC Functions," *SICCAPH Newsletter,* no. 5 (1971): 2.

A fourth goal for the group was added two years later, in 1973:

> 4. Promote the interest of professionals by:
>   a. Affording opportunity for discussion of problems of common interest.
>   b. Encouraging presentation of papers of special interest to this group at annual and Regional Meetings of the ACM and at other special meetings organized by this group.
>   c. Providing guidance to the ACM Council on matters of importance to this group.
>   d. Publishing a newsletter containing information of interest to this group.
>   e. Other appropriate means.[155]

The goals of SIGCAPH were mostly focused on the promotion of computer professionals with disabilities; especially in their early years, the newsletter reflects this by printing information on educational programs geared toward people with disabilities, technical articles on specialist technologies used by disabled professionals, and letters from or biographies about the experiences of people with disabilities working in computer-related occupations. In addition to professional concerns, however, the SIG also promoted research and technologies that would aid the general disabled population. SIGCAPH encouraged both specialized adaptive devices for people with disabilities, as well as general accessible technologies that allowed more people to use computers.

Around the same time the Office of Civil Rights was drafting the regulations of Section 504, as I discussed previously, another office in the Department of Health, Education and Welfare, the Social Security Administration, requested the assistance of members of SIGCAPH to contribute their knowledge and experience in developing an accessible government-run computer center. In late 1973, the SSA asked SIGCAPH members to review the new computer center's building specifications, so that architectural barriers were not included that would prevent the access of people with

155 Lois Leffler, ed., “Bylaws for SIGCAPH,” *SIGCAPH Newsletter,* no. 9 (1973): 7.

disabilities.[156] In July 1974, the SSA reported on the successful creation of the computer center. In a letter to SIGCAPH, the president of Computation Systems—the company hired to write the building specifications—commented on member involvement:

> To exemplify the kinds of value that can be added to a specification by people who really know and care, let me mention just one item: In the comments that came from one SIGCAPH member (on behalf of the Cleveland Institute for the Blind) there was marked, in the section on walks and ramps, the three-word marginal note, "no side slopes". Nowhere in the documents we have seen does there appear this simple but important specification.[157]

In order to build in accessibility, designers must be aware of the needs of people with different kinds of disabilities and how they use assistive technologies; in this case, building gradual slopes on the sides of walkways would make it difficult for blind people to tell which level surface they were walking on. By working with people who had expertise and experience in matters of accessibility, this computer center was able to include architectural details that were not yet part of standardized guidelines for accessible design.

However, as with other organizations that were required by federal law to become accessible only to run into economic obstacles, SIGCAPH's own commitment to accessibility was hampered by economic concerns. A small example will illustrate a larger issue: Accessible technologies are differently usable for users with different disabilities, which complicates efforts at universal design for computer technology. SIGCAPH had to find a balance between economics and accessibility in their choice of what version of their newsletter to supply to visually impaired subscribers. When the group formed, they decided that the braille version of the newsletter should not cost more

---

156 Robert A. J. Gildea, "Chairman's Message," *SIGCAPH Newsletter,* no. 10 (1974): 1.
157 Herbert S. Bright, "Letter to SIGCAPH." *SIGCAPH Newsletter,* no. 12 (1974): 7.

than the text version, on the basis "that there should be no distinction in membership fees because of handicap. Any slight difference in the cost of print or braille editions should be borne by the full SIG membership, just as well as it should bear the cost of interpreters for the deaf at business meetings, special meetings, or conferences as agreed upon by the SIG."[158] The group was able to maintain the braille edition of the newsletter for eight years, until the costs finally became infeasible.

From the organization's perspective, switching from braille to audio was a pragmatic economic concern, but for users, it was an issue of usability in how they chose to read the newsletter. Dropping the braille version and replacing it with audio tape was first considered in 1978, as braille then cost five times greater than audio tape.[159] The newsletter published a letter from a Norwegian member, Kari Larsen, who asked that this change not occur, arguing that:

> The information explosion we experience every day, makes it necessary to read exactly those articles that are of major interest to us. We know that blind people is [sic] very far from obtaining all the written information that seeing people get. … As an experiment, why not send printed versions of the newsletter only to deaf persons, and cassettes to everybody able to hear? May be some of us will find that it takes too long time [sic] to listen to the newsletter and that it is too difficult to find the interesting articles?[160]

The two options of ways to deliver a newsletter was not only a matter of economic concern, for members with visual impairments, but of usability; the practice of reading differs with these different technologies. As Larsen explains, it was far more difficult for him to skip around an audio tape version of the newsletter than with braille, as well as being more time consuming to listen rather than read by touch. SIGCAPH's budget was

---

158 *SIGCAPH Newsletter*. "SICCAPH Mid-Winter Meeting." no. 6 (1972): 3.

159 Wayne Muth, ed., "An Idea: Should We Drop the Braille Version of SIGCAPH Newsletter and Shift to Cassette Tapes Instead?" *SIGCAPH Newsletter,* no. 23 (1978): 3.

160 Kari Larsen, "Reg.: Drop Braille Version? NO!!! (SIGCAPH no. 23)," *SIGCAPH Newsletter,* no. 24 (1978): 13.

able to support the braille edition for a couple more years beyond this point, before this issue had to be dealt with permanently. The group discontinued the braille edition of the newsletter in 1980, as it then cost almost $10 per copy. Rather than charging members who wanted a braille version more than those receiving the text newsletter, the braille was replaced with an audio tape version.[161] SIGCAPH opted to change the form of the accessible technology they used, in order to accommodate their visually impaired members equally in terms of cost, even though the new technology was less usable for some. Striking a balance between economic concerns and the differences in usability for different people will be repeated throughout the development of accessible personal computer technologies.

2.2.3 Murray Turoff and Computerized Conferencing

One of the first computer technologies specifically created to benefit people with disabilities while also designed for more general use was computerized conferencing. In 1975, computer science researcher Murray Turoff gave a talk at a meeting of the American Association for the Advancement of Science on early research into this technology, a predecessor to future online communication technologies.[162] Computerized conferencing was a system where multiple people could communicate together online. Similar to later internet message boards, participants could write to each other at the time of their choosing, with all messages in the group conversation stored online on a central server. Turoff describes the unique properties of this technology as a communication medium:

[161] Wayne Muth, ed., "The Shift to Tape Cassette," *SIGCAPH Newsletter,* no. 26 (1980): 2.
[162] A precursor to technologies such as e-mail and chatrooms.

> 1) The individuals no longer have to be coincident in time, as in telephone calls or face-to-face meeting, since the computer keeps a record of the discussion and a bookmark for every individual on what he has seen.
> 2) The system allows each individual to work at his own pace, taking as much or as little time as he wishes to read, contemplate and/or reply (i.e., a "self activating" form of communication).
> 3) The system provides many of the signals present in face-to-face communication, i.e., who is in the discussion at any particular instant, what everyone has seen or not seen, when they were last in the meeting, etc.
> 4) The system provides a host of unique features, i.e., private messages or whispering between individuals, items that can be voted on, specialized retrieval —key words, authors—to reorder the discussion, conditional messages, etc.[163]

Computerized conferencing allowed for communication between people without some of the limitations of face-to-face communication, as participants could interact with each other on their own time and in their own space.

Turoff believed this aspect of the technology would make it particularly useful for people with disabilities:

> It is the view of the author that this type of communication offers tremendous potential for improving the opportunity for these individuals to lead more rewarding lives and to decrease greatly the limitations often imposed upon their mental capacity by the presence of inhibiting physical disabilities. While I may sound overly enthusiastic, the need for conducting trials of this area because of the possible opportunities that may be opened up by computerized conferencing for the deaf and handicapped is obvious.[164]

The disabled user is the imagined or ideal user here. This technological system designed with the needs of people with disabilities specifically in mind allows it to be usable by everyone, while providing accommodations for people with different abilities to participate in a new form of social interaction. The following year, Turoff began the trials he hoped for, asking for interested groups of computer users with disabilities to test a new system.[165] While computerized conferencing, as a specific technology, did not endure as

---

163 Murray Turoff, "Computerized Conferencing for the Deaf and Handicapped," *SIGCAPH Newsletter,* no. 16 (1975): 5.
164 Ibid.
165 *SIGCAPH Newsletter,* "Conferencing System for Handicapped," no. 19 (1976): 1.

Turoff and his fellow researchers imagined, it was a predecessor to current ubiquitous networked communication technologies. The prominent place of people with disabilities in the writings on computerized conferencing makes this an ideal case for me to examine themes of the computer as a universalizing technology of augmentation.

The most prominent publication of Turoff's research was his 1978 book, *The Network Nation: Human Communication via Computer,* which he co-wrote with sociologist and computer researcher Starr Roxanne Hiltz on what they saw as the future for computerized conferencing and its potential impact on society.[166] In the preface to the book, the authors write: "We believe that [computerized conferencing] will eventually be as omnipresent as the telephone and as revolutionary, in terms of facilitating the growth and emergence of vast networks of geographically dispersed persons who are nevertheless able to work and communicate with one another at no greater cost than if they were located a few blocks from one another."[167] This technology would not just offer a new means of communication, in their view, but it would organize new networks of human interaction across the world. These networks would be based, not on geographical proximity, but on connections unbound by physical location:

> We will become the Network Nation, exchanging vast amounts of both information and social-emotional communications with colleagues, friends, and 'strangers' who share similar interests, who are spread out all over the nation. Ultimately, as communication satellites and international packet-switched networks facilitated by computer-mediated communications will become international; we will become a 'global village' whose boundaries are demarcated only by the political decisions of those governments that choose not to become part of an international computer network. An individual will, literally, be able to work, shop, or be educated by or with persons anywhere in the nation or in the

[166] Starr Roxanne Hiltz and Murray Turoff, *The Network Nation: Human Communication via Computer* (Reading, MA: Addison-Wesley Publishing Company, Inc, 1978). A second edition of the book was published in 1993.

[167] Ibid., xxv.

world.[168]

Hiltz and Turoff's predictions for the future of computer technology were highly accurate. Built into this view of the future are the implied values of the computer as a universalizing technology: a technology for any purpose that can unite users across the world and break down geographical boundaries. At the same time, the computer becomes the necessary means by which to accomplish such a "global village," as it permits people to overcome the physical limitations that prevent such networks from existing without computer-mediation.

People with disabilities, in particular, were a group Turoff and Hiltz saw as benefiting from computerized conferencing technology. The authors write that, "the biggest advantage of computer-mediated communication is that it spans space and time barriers, allowing a person to work, learn, and communicate from those places and at those times that are most convenient for him or her. Thus the mobility limitations of the physically handicapped make them a disadvantaged group that can benefit greatly from this technology."[169] As seen with legislation that required technological accommodations to be provided in order for people with disabilities to participate fully in society, computerized conferencing functions as another technology of accommodation. Like a building designed to be barrier-free so that anyone can access it, computer-mediated communication was envisioned by Turoff and Hiltz as a technology that was designed to take into account use by people with disabilities. Computerized conferencing would create a space for social interaction which included people with disabilities as the intended user. This new form of communication acted to augment all users' abilities to

[168] Ibid., xxix.
[169] Ibid., 169.

interact with each other in a new social arrangement; it created networks independent of space, as well as a means of communication that was not instantaneous and therefore less dependent on time.

This view of computerized conferencing as a technology to augment all users' abilities to communicate continued with research done by Turoff and Hiltz at the New Jersey Institute of Technology (NJIT). In 1979, their research was reported on in the SIGCAPH newsletter, specifically on the use of computerized conferencing to connect groups of elderly women with children who had cerebral palsy.As part of an NSF-funded grant, the NJIT program brought women at a nursing home together with children at a Cerebral Palsy Center to communicate with each other via a computerized conferencing system. Led by Turoff, the focus of this study was on the emotional well-being of the participants using the technology: "The NJIT scientists are convinced that the continual availability of someone eager to 'listen' can bring a new meaning to life, both for the handicapped children and for the elderly women."[170] These two groups of people were chosen because of their relative isolation and dependence on others for care-taking, with the idea that these women and children may desire communication with people external to their restricted environments. Computerized conferencing was seen as particularly useful, because the speed at which the participants typed did not matter to the system.[171] For these researchers, computerized conferencing could help to create a more level playing field, where one's disability did not impact one's communication with others. Users with disabilities were the test case, the initial users whose needs had to be met

[170] New Jersey Institute of Technology, "Research Activity... 'Computer Conferencing'...," *SIGCAPH Newsletter,* no. 25 (1979): 12.
[171] Ibid., 14.

before the technology was then generalized for all users.

Hiltz and Turoff explicitly viewed computerized conferencing as a technology of human augmentation, where: “a goal of [computerized conferencing] systems is augmentation of communication processes by the presence of the computer.”[172] For people with a disability that affected face-to-face or telephone communication, computerized conferencing promised a means of communication where disabilities were potentially unseen. The authors describe this feature explicitly:

> ...various participants need not be aware of the disability that any of them suffer unless a person wishes to volunteer the information.... Even if the participants are aware that a particular person is blind or deaf, the social salience of the characteristic is much less, because it is not visible. Moreover, if it takes a handicapped person longer to read and/or write into a system, this does not slow down or inhibit the speed or ease of participation of the other members.[173]

The authors promoted computerized conferencing as a way to not only grant someone abilities they did not otherwise possess, but to cover the disabilities they had. Compared with the blind programmers I discussed earlier, who were required to prevent their disability from negatively affecting their co-workers, computerized conferencing offered a non prescriptive option to the user to choose whether they revealed their disabilities, along with any other aspects of their identity, to others. There was liberatory potential in not having to hide or show oneself, but also the possibility of invisibility and assumptions of normativity by other users. One of the goals of computerized conferencing was to remove a person's disability from the act of communication, in so far as possible, both by making participants unaware of each other's disabilities and by providing a communication system that is relatively unaffected by disability. People with disabilities

---

172 Hiltz and Turoff , *The Network Nation,* 338.
173 Ibid., 173.

were explicitly imagined as users of this technology; making it work for people with different physical needs was a part of the propulsion for innovation in creating a cutting-edge technology and new form of communication. This research into computerized conferencing was about more than just accommodation; it challenged ideas of normalcy and showed that both personal technologies and new social environments could be developed with the needs of different people in mind.

2.2.4 IBM and People with Disabilities

The final part of the computer industry I discuss is a computer developer itself, International Business Machines (IBM), and its work on accessible computer technologies and computer professionals with disabilities prior to the personal computer. IBM functions as a bridge between the efforts to include people with disabilities as users of early computers and the work to build accessible personal computer technology to come. IBM was founded in 1911 as the Computing-Tabulating-Recording Company; it was renamed to International Business Machines Corporation by its president, Thomas J. Watson, in 1924.[174] Developing mechanical tabulating and accounting machines initially, the invention of the digital computer in the 1940s turned IBM's attention toward mainframe computing. IBM dominated the computer industry during much of the mid-twentieth century, controlling around seventy percent of the market from the late 1950s through the 1970s.[175] Paul Ceruzzi describes the fundamental reason behind IBM's mid-

---

[174] The creation of the Computing-Tabulating-Recording Company, in 1911, was a merger of three companies: the Tabulating Machine Company, the International Time Recording Company, and the Computing Scale Company of America. The products developed by the Tabulating Machine Company, founded by Herman Hollerith, in 1896, would become the basis for IBM's early business. See Emerson W. Pugh, *Building IBM: Shaping an Industry and Its Technology* (Cambridge, MA: MIT Press, 1995), chapter 2: “Origins of IBM.”

[175] Paul Ceruzzi, *A History of Modern Computing,* 2nd ed (Cambridge, MA: MIT Press, 2003), page 110.

century success in his *History of Modern Computing* as, simply, “In the mid-1950s the IBM Corporation developed a line of products that met the information-handling needs of American businesses.”[176]

As it rose in power to dominate the computer industry, IBM also hung onto some of the progressive values that Thomas Watson and his son instilled in the company. These values included hiring practices that promoted diversity: across gender, race, and disability.[177] IBM hired its first employee with a disability in 1914—a continuing point of pride for the company.[178] In 1944, IBM's efforts to hire people with disabilities were recognized by a Congressional subcommittee as, according to IBM, “a shining example other companies might follow.”[179] During World War II, its efforts to hire and train people with disabilities were motivated by the need for a large workforce that had been diminished by soldiers leaving for the war, as well as creating accommodations for disabled veterans.[180] By 1977, IBM could feature a number of people with disabilities in various positions within the company, in its company magazine, *Think.* This sampling of employees included people with various disabilities who worked in management, programming, administration, and engineering.[181] Of the seven employees featured, three

---

Seventy percent is the commonly used figure to describe IBM's control of the market; however, Emerson Pugh argues in his history of IBM that this number was based on a limited conception of what constituted the computer industry. During their Justice Department lawsuit, IBM supplied figures that put their control of the market at sixty percent during the 1950s and down under forty percent by the 1970s. Pugh, *Building IBM,* 319.

176 Ceruzzi, *A History of Modern Computing,* 14.

177 IBM, "Think: A History of Progress: 1890s to 2001," 2008, accessed August 11, 2012, http://www-03.ibm.com/ibm/history/interactive/ibm_history.pdf.

178 Annemarie Cooke, "A History of Accessibility at IBM," *Access World* 5, no. 2 (March, 2004). Accessed August 29, 2012. http://www.afb.org/afbpress/pub.asp?DocID=aw050207 and "Seventy years of enabling the disabled," *Think*, no. 3 (1988): 43.

179 Claire Stegmann, "Handicapped? Not on the Job," *Think*, July/August 1977: 42.

180 IBM, "IBM's focus on accessibility," 2008, accessed August 11, 2012, http://www-03.ibm.com/able/product_accessibility/ibmcommitment.html.

181 Stegmann, "Handicapped? Not on the Job," 42-47.

had worked on projects at IBM to develop assistive technologies or training for other people with disabilities. A decade later, in 1988, IBM employed around 7000 people with disabilities, out of their global workforce of more than 387,000.[182] That same year, IBM was named Employer of the Year, by the President's Committee on the Handicapped, for its long history of employing people with disabilities.[183] IBM's long-standing dedication to employees with disabilities appears to be a part of its practice of supporting a progressive workplace, through diverse hiring standards and enforced anti-discrimination policies.

IBM accommodated the needs of its employees with disabilities through numerous alterations to make their workplace accessible. A *Think* article from 1988 described some of these accommodations, including: removing architectural barriers and making changes to buildings to allow access by people with mobility related disabilities, providing captioning for videos and sign language interpreters at meetings for deaf employees, offering audio versions of bulletins and *Think* magazine for blind employees, and making workplace technologies accessible through the use of adaptive devices.[184] These workplace accommodations were notable two years before the passage of the Americans with Disabilities Act required such workplace changes for employees with disabilities. IBM's support of people with disabilities included both hiring people and creating a workplace where their physical needs were met, enabling employees with disabilities so that they could perform their jobs the same as their non-disabled colleagues.

---

[182] "Seventy years of enabling the disabled," 43 and Pugh, *Building IBM,* 324.
[183] Kathy Kafer, "A Fair Chance," *Think*, no. 3 (1988): 41.
[184] "Seventy years of enabling the disabled," 43. Though this article is from the late 1980s, the types of accommodations it describes are not specific to the personal computer, but are the types of accommodations that any employer would need to enact to create a barrier-free workplace.

In addition to employing people with disabilities, IBM also ran programs to train non-employees for computer careers. In 1968, the company created a rehabilitation department in its Office Products Division. The product manager in 1972, Bert Williams, described the department's work at a time when they found no similar programs to base theirs on:

> Our goal is not just rehabilitation, but to help each individual realize his or her maximum potential. There were no precedents for us to follow in this work.... Our people act as catalysts, calling on organizations where we feel we can help. They help define a need and develop a program to meet it, using the training resources we've already developed, and then support the local community in making it work.[185]

The early 1970's perspective on disability in IBM's rehabilitation department anticipates arguments by disability and technology activists in the 1980s on the possibility of personal computer technology enabling people with disabilities to pursue their goals. Williams also described IBM's emphasis on training people to use computers, rather than just donating technology to charities and individuals.

> We receive many requests for machines to be used in training handicapped people. We feel that the real need is not for donated machines, but rather business involvement with good programs that have sufficient skills development to insure pursuit of a career path in a job that is guaranteed at the end of the course. Now we know that it's the total program that counts—not just handing out machines.[186]

IBM helped people with disabilities to find work in computer-related careers through training programs the company organized; these resulted in thousands of people placed in jobs that allowed them to utilize the kinds of technical skills that Williams discussed.

In 1972, IBM started their Computer Programmer Training for Severely Physically Disabled Persons program. It began from a suggestion by an IBM employee

185 Quoted in A.N. Borno, "A Lifeline to Society," *Think*, March 1972: 17.
186 Ibid.

with disabilities.[187] By 1988, there were thirty centers across the U.S. where people with disabilities could receive training in computer programming. 2400 people graduated from the training program during this time, with an 80-85% success rate in finding jobs.[188] The program later broadened its focus in terms of both training and who could be admitted into the Personal Computer Based Skills Training for Disabled Persons program, leading to 3000 graduates from forty centers by 1996. Beyond computer programming, the program added training on personal computer use in “word processing, data entry, desktop publishing, and computer-aided design.”[189] With the personal computer, IBM's emphasis on employment for people with disabilities would change to a focus on personal use and empowerment.

In analyzing both the history of disability rights legislation and use of computers by people with disabilities prior to the personal computer, I introduced five historical themes that I will return to in further chapters: First, disability rights underwent a shift during the late 1960s from a paternalistic, caretaker model to a civil rights-based model. The view of people with disabilities slowly changed from them being a burden on society that they could try to alleviate—by taking part in vocational programs in order to find gainful employment—to a view of people with disabilities having personhood and the right to fully participate in society. The struggle for civil rights for people with disabilities coincided with the rise of identity politics in the U.S., as disability became a social identity and movement comprised of a population fighting for equality. Their civil rights

[187] IBM National Support Center for Persons with Disabilities, *Technology for Persons with Disabilities: An Introduction* (n.p.: IBM, 1990), 17.

[188] "Seventy years of enabling the disabled," 43.

[189] Jay W. Spechler, *Reasonable Accommodation: Profitable Compliance with the Americans with Disabilities Act* (Delray Beach, FL: St. Lucie Press, 1996), 129.

were guaranteed by federal legislation such as the Architectural Barriers Act of 1968, Section 504 of the Rehabilitation Act of 1973, and the Education of All Handicapped Children Act of 1975. With this change, the segregation of people with disabilities in special programs, isolated from the rest of society, decreased, and they slowly became integrated into mainstream programs with everyone else. Throughout this shift, the rights of people with disabilities have historically been spoken for by different groups: activists, lawmakers, judges, employers, and of course people with disabilities themselves.

Second, in order to fully participate in society and have equal rights, people with disabilities require technological accommodations. Public space and many technologies are designed for use by people without certain disabilities; therefore that space or technology has to be altered to allow people with disabilities to have full access. Technological accommodations include both the removal of architectural barriers and assistive technologies that allow a person to participate in school or work. The economic cost of technological accommodations has affected their enactment historically, whether in the form of an elevator to access a metro station or the replacement of a braille newsletter with an audio tape version. Even when institutions have been required to provide accommodations under federal law and desired to enact such accommodations, costs have been an obstacle.

Third, the personal computer functions as a technology of accommodation influenced by the values embedded into it, in particular, that of being a universalizing technology, a tool for anyone, for any purpose. In spite of these values, just as people with disabilities who seek access to a building require accommodations, computer users with disabilities also require specialized accessible technologies in order to reach the potential the technology promises. For blind computer programmers in the 1960s, working on mainframe computers, these accessible technologies took the form of small devices or changes to the work process that allowed them to do their jobs. For personal computers in the 1980s to be accessible to all users, I will demonstrate the complexity of accessible technologies, in terms of both their development by computer companies and their use by people with disabilities.

Fourth, in addition to its value of being a universalizing technology, the personal computer also carries with it the idea that it is a technology of augmentation, that it allows people to expand their intellectual abilities, which are limited by their bodies. The computer provides abilities that no person possesses on their own. Computerized conferencing and later computer networking created new forms of communication that allowed people to interact in their own time and space. In the view of augmentation, everyone is disabled from the perspective of the computer; it is inherently an assistive technology.

Fifth, understanding the computer only as a technology of augmentation that makes up for limitations all people possess misses the lived reality of its use. The computer can never provide a completely level playing field where everyone has the same opportunities and abilities, because it is still a machine used by people with bodies. Differences in those bodies—such as the presence of a disability—matter to the person using the technology. Even if the guidelines of universal design are followed, the computer can still never be used in the same way by all people. There are differences between the purpose of a technology for its developers, the values imprinted in it, and its use.

From a view of people with disabilities as helpless and needing the charity of a paternalistic society to people with disabilities as people in their own right, with their own goals and desires to participate in the world as everyone else does, the twentieth century United States witnessed a profound change in the lives of people with disabilities. Legislation began to grant them rights and technological accommodations began to address some of the disabling aspects of society. The development of computer technology created both jobs and the possibility of future accessible technologies that might benefit people with disabilities. With the birth of the personal computer in the 1970s, the potential of computer technology would be realized with machines anyone might own at home. First, though, technical knowledge needed to be disseminated to those not on the forefront of technological innovation and, just as with buildings or public transportation, adaptive devices would need to be developed to make computers usable for everyone.

Chapter 3

Early Personal Computer Accessibility, 1980-1987

The personal computer began to be available as a consumer product in the late 1970s. These early machines were limited in usability and functionality, yet carried with them embedded values of the computer as a universal tool and one of human augmentation. The potential immanent in computers to change people's lives for the better spurred immediate tinkering of the technology for use by people with disabilities, but a lack of standardization and the absence of social technologies to transmit awareness meant that it took until the mid-1980s for accessible computer technologies to begin to be readily available, affordable, and easy to use. I trace this evolution of accessible personal computer technologies, during the early to mid 1980s, from their birth in entrepreneurial tinkering, to their development as consumer technologies in both small start-up companies and large-scale computer corporations, while examining how personal computer technology was taken up and promoted by people with disabilities and activists. I argue that problems with large computer companies not taking on the mantle of accessibility and a lack of knowledge reaching consumers hampered access to personal computer technology for people with disabilities, until the emergence of social technologies, such as advocacy groups, which created networks of information sharing between producers and consumers.

3.1 Computer Potential

In the late 1970s and early 1980s, the promise of computer technology for people with disabilities was there, but still unrealized. The values embedded in the personal computer of it being a universal tool for any purpose and a technology of human augmentation made it replete with potential for people with disabilities. First though, developers needed to set standards of what the personal computer should be, in order to allow people with different needs to utilize the technology. In addition, social technologies—communication and organizational networks—had to be built in order for the liberatory potential of the personal computer to manifest.

Early personal computer technology was seen as a tool that offered access to a nonphysical public space. Even in the early 1980s, the possibilities of conducting one's everyday life online though the personal computer were anticipated. This was especially true for people with mobility impairments, as the computer could potentially allow them to accomplish public business, such as shopping or money management, without having to leave home. At this time, the promise of the personal computer was that it might give people with disabilities the same opportunities in society that non-disabled people enjoyed. Optimism reigned. In 1984, Peter McWilliams wrote in his book, *Personal Computers and the Disabled*: "Personal computers can make the difference between communication and isolation, between productivity and non-productivity, between independence and dependence."[190] Dolores Hagen, in her 1984 book, *Microcomputer Resource Book for Special Education,* spoke of the role the personal computer had played

[190] Peter A. McWilliams, *Personal Computers and the Disabled* (Garden City, NY: Garden Press, 1984), 14.

in her son's life: “Telecommunications via the microcomputer will, for the first time, give the handicapped equal opportunity in society.”[191] The promise of the personal computer as a tool to solve people's problems and open up the world speaks its origins in the counterculture-hobbyist environment of Silicon Valley, as discussed by Fred Turner in his book, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*.[192] For early developers, the personal computer acted as a successor to the Whole Earth Catalog, exemplifying the same goal of being tools that provided a means for people to create the kinds of lives they chose to live; where the catalog offered all the physical objects that would permit people to build a new society, the personal computer provided the means for people to create their own digital forms of problem-solving and social interaction.

However, early personal computers were not designed for people with disabilities in mind and first had to be made accessible. Gregg Vanderheiden, of the Trace Center[193] at the University of Wisconsin-Madison, drew attention in the early 1980s to this need:

> Very rapidly, our society is moving toward electronic assisted everything. In the process, electronic pathways are being laid throughout our society—pathways which could tremendously increase the functional mobility and capabilities of individuals with physical and sensory disabilities. All of these electronic information pathways will be of little use, however, if unrestricted access is not available. Patching one or two access points is not sufficient, in the same manner that providing curb ramps or curb cuts for some of the sidewalks is not sufficient.[194]

---

191 Dolores Hagen, *Microcomputer Resource Book for Special Education* (Reston, VA: Reston Publishing Company, Inc., 1984), 9.

192 Turner. *From Counterculture to Cyberculture*.

193 The Trace Research and Development Center on Communication, Control, and Computer Access for Handicapped Individuals at the University of Wisconsin-Madison is a major location for work on disabilities and computers in academia in the U.S.

194 Gregg C. Vanderheiden, *Curbcuts and Computers: Providing Access to Computers and Information Systems for Disabled Individuals* (Madison, WI: Trace Research and Development Center, 1983), 5, http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED289314

His main argument was that being able to make one's home computer accessible—and have access to all the possibilities the computer offered from home—was not enough; it would be like only having curb cuts on the sidewalks around your block. Vanderheiden predicted that computers would quickly become necessary in all aspects of public life: everything from education to employment to banks to government offices would soon be run by computers. If a person could access their own computer, after modifying it with available adaptive devices and specialized software to fit their own needs, but not be able to access public machines, then the computer revolution would do nothing but create new barriers. As both a personal and public technology, all personal computers needed to have some means of accessibility built into them to accommodate the needs of different bodies if computers were going to grant access to a new digital world for everyone.

In the early 1980s, personal computer technology was still undeveloped enough that, while accessibility features were not commonplace, a lack of accessibility had also not yet been built into its standards. Until the mid-1980s, however, large computer companies showed little interest in developing their own accessible technologies. Deaf activist and former head of the American Coalition of Citizens with Disabilities, Frank Bowe discussed the need for computer manufacturers to make their technologies work for people with disabilities as a standard, concluding that: "Just as buildings had to be made accessible before physically disabled and older people could use them, so too will computers have to become accessible before special-needs persons can become full partners in the computer revolution."[195] Unlike buildings designed only with an able-bodied user in mind, computers were still unfixed enough that a lack of accessibility

[195] Frank G. Bowe, *Personal Computers and Special Needs* (Berkeley, CA: Sybex, 1984), 133.

could be undone before standards were set and the technology stabilized.[196] By including accessibility concerns in the development of personal computers early on, the technology would not be made disabling. Vanderheiden likened this to creating curb cuts while the sidewalk is still being laid, instead of waiting until later and having to tear up the concrete to build in accessibility.[197] Different uses of computer technology by people with different bodies would need to be anticipated and understood, in order for the computer to not be standardized with obstacles built in.

3.2 Johns Hopkins' Contest on Personal Computing to Aid the Handicapped

Researchers and innovators tinkering with personal computer technology began to make good on its potential for people with disabilities in the early 1980s. Prior to most standards being set, these technologists created prototypes of technologies that would, in only a few years, become consumer technologies that would enable people with disabilities to use personal computers. A number of prominent computer innovators took part in a competition in 1980 and 1981 to reward people seeking to put computers toward the benefit of people with disabilities: the First National Search/Contest on the Application of Personal Computing to Aid the Handicapped, run by Johns Hopkins University's Applied Physics Laboratory, with sponsorship from the National Science Foundation and Radio Shack. The contest brought together the top regional submissions for a final national contest. The top three winners were awarded $10,000, $3000, and

[196] Bowe uses an argument here made by Richard Heddinger, a statistician and federal employee involved with filing the lawsuit against the DC Metro system in 1972. Ibid., 133-134.

[197] Vanderheiden, *Curbcuts and Computers*, 5.

$1500 respectively, with a further seven honorable mention winners of $500 each.[198] I examine each of these winning inventors and their technologies to construct a broad view of who was working on computer accessibility at the time, the kinds of personal computer technologies available, and their potential application for people with disabilities. This set of winning technologies not only provides a glimpse at early versions of accessible computer technologies that would go on to become common, consumer products, but also offers examples of the different kinds of embodied uses personal computer developers needed to be aware of, if the computer was going to be usable by everyone.

A notice of the contest in the ACM SIGCAPH newsletter described its objectives as: "a) Focus the power of computing technology on the urgent needs of millions of handicapped citizens. b) Harness individual innovation & creativity on a national basis."[199] The capabilities of computers to help people with disabilities were seen as "virtually unlimited."[200] Contest entrants were divided into Professionals, Amateurs, or Full-Time Students and their entries were categorized as Computer Based Devices (hardware), Computer Programs (software), or System Concept/Design (ideas with implementation). A key rule of the contest was that off-the-shelf components, with modifications, were required to be used, as a way to demonstrate the possibilities for consumer technologies to be adapted for use by people with disabilities with relatively little tinkering. The competition defined disabilities broadly, as "any limitation of

---

198 "Personal Computers Help the Handicapped: Johns Hopkins Rewards Inventors," *Creative Computing*, March, 1982, 54-55.

199 *SIGCAPH Newsletter*. "Personal Computing for the Handicapped (National Contest)." no. 29 (1981): 16.

200 Ibid., 17.

functional capabilities including mobility, communication, self-care, and self-direction."[201] Computers, here, through the creativity of inventors, could help anyone improve their life. From the perspective of the organizers, even the earliest personal computing technology, available in the first few years of its existence as a consumer technology, held the potential to change the lives of people with disabilities for the better. The contest's director, Paul L. Hazan described this potential as: "From aids to independent living to flexible tools that can greatly increase the variety and quality of job opportunities, the rapidly evolving field of computing is pregnant with possibilities."[202] The computer holds the promise again of being a universal tool, for any job, that anyone can use.

The plethora of different technologies intended for use by people with widely different disabilities featured in the contest indicates two salient aspects of personal computer technology and accessibility at this time. The first is the wide range of possibilities that the technology offered; personal computers promised to be a technology for any imagined use, where limitations that existed one day would be overcome by advances the next. The contest's requirement to use as near to off-the-shelf components as possible shows how even early personal computer technology could be adapted to uses beyond what were intended. Second and following from this, accessibility and the use of personal computers by people with disabilities was, for the most part, not an integral part of the design of early personal computers. Devices had to be adapted, components altered, and software written, in order for people with varying disabilities to use this

---

[201] Ibid.

[202] Paul L. Hazan, "Computer and the Handicapped: Guest Editor's Introduction," *Computer,* Jan. 1981, 9.

technology.

The First Place winner was Harry Levitt from City University of New York. He used a TRS-80 Pocket Computer and a modem to create a mobile communication system for deaf people which would operate over public phone lines—a low-cost, improved version of the teletypewriter (TTY) already in use. Levitt's Portable Telecommunicator for the Deaf allowed users to transmit messages via a computer keyboard over phone lines, store the messages in memory, print messages, and read from an audio cassette. He saw a need for his device in the way hearing and deaf phone users interacted differently with the phone system. Specifically, hearing users were able to make urgent phone calls in public places using pay phones, but deaf users had no real access to pay phones, without some portable communication system. Levitt's Telecommunicator could replace TTY systems which were heavy, expensive, slow, and had no means to store messages.[203] Levitt also saw his device as a stepping stone to future technologies that would benefit deaf people: "Perhaps the most important advantage of all is that the use of a pocket computer as a convenient, inexpensive communication device introduces the deaf telecommunicator user to the concept of an intelligent, computer-based communications system of almost unlimited scope and flexibility."[204] He hoped that by using commonplace personal computer technology with great potential that barriers between deaf and hearing people could be reduced.

The Second Place winner, Mark Friedman of Carnegie-Mellon University,

---

[203] Harry Levitt, "A Pocket Telecommunicator for the Deaf." In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 39. Los Angeles, CA: IEEE Computer Society, 1981.

[204] "Personal Computers Help the Handicapped: Johns Hopkins Rewards Inventors," *Creative Computing*, March, 1982, 54.

developed a communication system for users who had both mobility impairments and were unable to speak. He and his co-researchers created the Eye-Tracker for Communication, which used an infra-red camera to follow eye movement and detect where a user was looking on a computer screen. The screen would display words in eight regions on the screen that the user could either select as final output or use to bring up another eight related and more specific words. The computer would read out loud the words the user selected, using a voice that was gender and age appropriate. The system was intended to be used by children who did not have steady control of another body part, with the understanding that eye movement would be less fatiguing for the user and faster than trying to control a mechanical switch.[205] The researchers initially ran the EyeTracker on an Apple II computer for use as a teaching aid and were developing a more personal system using a Rockwell AIM-65 computer with a built-in printer. Their ultimate goal was to develop a portable system the size of a portable television. The potential of the personal computer to improve people's lives lay at the heart of their research:

> Throughout our work, we have tried to maintain the principal that, wherever possible, we should use the 'intelligence' of the personal computer to minimize the physical and mental effort that handicapped users must expend to use our communication aids. To the extent that children voluntarily use the EyeTracker Communication System, we will feel that we are successful in our efforts.[206]

The EyeTracker was intended to be quick to learn and easy to use, so that people would want to use it to communicate with.

The Third Place winner, Robin L. Hight, developed a system for deaf people, the

205 Mark B. Friedman et al., "The EyeTracker Communication System," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 183.

206 Ibid., 185.

Lip-Reader Trainer, for the Apple II which could convert text a user typed to animated mouth movements as a way to better learn lip-reading. A teacher could use the program to construct multiple-choice tests, with mouth animations and a number of possible answers. The program created the animation from a phonetic sentence the teacher gave it using nineteen different mouth shapes. Students could view the animation as many times as needed, adjusting for animation speed. The system was not designed to replace face-to-face teaching of lip-reading, but was intended as a supplement that students could use when not working with a human teacher.[207]

The seven honorable mentions of the national finalists consisted of a wide variety of inventions, all using modified off-the-shelf technology. Joseph T. Cohn developed an Augmentative Communication Device that could use a personal computer as a prosthesis for severely disabled people to communicate with. A variety of switches could be controlled with small muscle movements (e.g. by raising an eyebrow or rotating the forearm), in order to select words or pictures that the Apple II computer would display.[208] A future chairperson of SIGCAPH, Randy W. Dipner, created a Micro-Braille System that could print braille cheaply, using modified commonplace microprocessor hardware, instead of an expensive, mechanical brailler. Dipner's system took text a user typed in, translated it into braille, and then printed it using a standard printer. He initially used an Intel 8080 and then switched to a Radio Shack TRS-80 Model III personal computer.[209]

---

207 Robin L. Hight, "Lip-Reader Trainer: A Computer Program for the Hearing Impaired," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 4-5.

208 Joseph T. Cohn, "Microcomputer Augmentative Communication Devices," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 43-44.

209 Randy W. Dipner, "The Micro-Braille System," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer

Similarly, Robert Stepp developed a Braille Word Processor which also had the benefit of costing little. Stepp's system used an Apple II with a modified keyboard to allow the user to type in braille and edit it with a word processor.[210] Focused on people with learning disabilities, Sandra J. Jackson and her co-researchers created Programs for the Learning Disabled, a software system for the TRS-80 to help teach students math and language skills. It was designed so that users would learn how the software worked by playing with it; the software in turn would alter its difficulty based on the student's performance.[211] David L. Jaffe used ultrasound technology with his Ultrasonic Head Control for a Wheelchair to allow a user to control their wheelchair via head movements. This non-contact system would track a user's head and wheelchair movements, so that the user could direct the chair and it would automatically avoid obstacles. The system used parts from a Polaroid camera to detect the wheelchair's distance to other objects.[212] Paul F. Schwejda created a Firmware Card Training Disk that provided a specialized interface for a user to use any software on an Apple II Plus with their own adaptive devices. Schwejda's goal was to get away from providing only specialized software for computer users with disabilities and, instead, offer a way for them to use any software. His device simulated a keyboard for the computer, so the user could plug whatever interface device they worked with into the computer and control it with the computer acting like the

---

Society, 1981), 244-245.

210 Robert Stepp, "A Braille Word Processing System," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 202.

211 Sandra Jackson, Judy Maples Simmons, and Tony Wedig, "We Help More," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 59-60.

212 David L. Jaffe, "An Ultrasonic Head Position Interface for Wheelchair Control," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 142-143.

device was a standard keyboard.[213]

Finally, Raymond Kurzweil, the prominent transhumanist inventor and future author of *The Age of Intelligent Machines* and *The Age of Spiritual Machines,* who I discussed in my Introduction, developed his Reading Machine for the Blind to convert text to speech using text of any size or format and possessed an unlimited English vocabulary. This was before Kurzweil was well-known for his futurist theories on the acceleration of scientific and technological progress, but he was already recognized during the 1980s for his inventions to aid people with disabilities. According to Kurzweil, his Reading Machine was the first computer that could convert text to synthetic speech.[214] The device received inputted text from a scanner, used Optical Character Recognition software to read the text, and converted it to speech.[215] Kurzweil's Reading Machine would become the leading, though expensive consumer technology to translate text for blind people. I will return to Kurzweil's transhumanist theories and their significance for people with disabilities in my Conclusion.

Some of the potential of the personal computer was demonstrated by the very fact that these innovators could create these technologies using off-the-shelf products. The value of the computer as a universal tool was enacted in its ability to be modified into assistive technologies that it was not explicitly designed for. Yet, for the most part, these

---

213 Paul Schwejda and Judy McDonald, "Adapting the Apple for Physically Handicapped User: Two Different Solutions," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 53-54.

214 Kurzweil won the 1978 ACM Grace Murray Hopper award for significant contributions by young computer professionals for his invention of the Kurzweil Reading Machine, as well as the software he developed that allowed a computer to recognize text characters of different size and shape.

215 Raymond C. Kurzweil, "Kurzweil Reading Machine for the Blind," in *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped* (Los Angeles: IEEE Computer Society, 1981), 236.

first personal computers were not built with user-friendliness in mind or the possibilities that people with very different bodies might want or need to use the technology. Large computer companies were not yet building standard accessibility features into early personal computers. The imagined user was still considered to be someone with a 'normal' body and 'normal' needs, not a multiplicity of possible differences. The first consumer available accessible personal computer technologies followed from innovators like those in the Johns Hopkins' contest; they or their ideas evolved into small, third-party companies creating these technologies for people with disabilities.

3.3 Accessible Personal Computer Technology for Consumers

By the mid-1980s, growing interest in the ways computers could be used by people with disabilities led to the emergence of many small businesses dedicated to creating specialist hardware and software. These companies were mostly tiny—many started by individuals building devices for their friends or family with disabilities—and were highly specialized. These developers created technologies that mostly allowed users with disabilities access to personal computers in their homes. At the same time, large computer companies paid little attention to building in accessibility features, while inadvertently making their machines more difficult to use for people with disabilities by not taking into account their needs. Two books were published in 1984 that described the state of available accessible computer technology and recommended devices to work for people with different disabilities: Peter A. McWilliams's *Personal Computers and the Disabled* and Frank G. Bowe's *Personal Computers and Special Needs.*[216] McWilliams, a

[216] These types of books, part technological analysis and part buying guides for accessible computer

journalist and author of self-help books, explained the basics of personal computers, interviewed technology developers working on accessibility, and listed details of available personal computers and adaptive devices that work with them. Similarly, Bowe, a prominent disability studies and special education professor and disability rights activist, focused on both current and future specialized computer devices for people with disabilities, as well as ways general software could be utilized by people with disabilities. The books are organized by type of disability (e.g. vision, hearing, speech, mobility, learning), specifying technologies appropriate to the needs associated with each singular disability. The variety of technologies these authors survey mirrors some of the diversity of needs of users and demonstrates the possibilities for innovative technological development when designers take these needs into account.

For computer users with hearing impairments, personal computers offered a new method of telephone-based communication. In addition to all the other functions a computer provided, it also worked as a Telecommunication Device for the Deaf (TDD); users could call other computers through their modems and communicate directly with people on the other end by typing. Editor and journalist Henry Kisor described the impact on his life that his computer had, in a 1984 interview:

> 1. For the first time, I am able to roll up as large a phone bill as my wife does.
> 2. For the first time, I am able to communicate with hearing people without having to look at their lips or write them letters and wait days for them to be delivered.
> 3. I am able to interview writers on the phone, as you are doing (though this is still a matter of potential ... most writers still use the goose quill, not word processors, and you can forget about modems, so far as they are concerned).[217]

The computer here provides the same functionality and social interaction as the telephone

---

technology, began to appear regularly in the mid-1980s.

[217] Quoted in McWilliams, *Personal Computers and the Disabled,* 56.

—even over the same phone lines—for deaf and hearing impaired people. By becoming early adopters of the newest computer technology, users with disabilities found new solutions to their needs, and in turn, helped to communicate the possibilities of the technology to both disabled and non-disabled users. One author recommended portable computers, in particular, to users taking advantage of early network communication capabilities, so that they could participate in phone-based communication regardless of where they were.[218] Writing from personal experience as a deaf person, Bowe also discussed computer technologies that could help deaf and hearing impaired people learn to write and speak. Both authors described the literacy problems hearing impaired people faced if they lost their hearing at a young age. Bowe suggested that even a basic grammar checker in word processing software could have a huge impact in improving the writing of deaf people, though at this time such a feature was still only a distant possibility.[219] To help deaf people and others with speech impairments, he also hoped that speech recognition software might one day provide a way for people to train and practice speaking using their computers.[220]

Unlike deaf users, blind people required more specialized adaptive devices in order to use personal computers—specifically, to understand what was happening visually on the computer screen. At this time, Raymond Kurzweil's Reading Machine, an honorable mention finalist in the Johns Hopkins' contest a few years earlier, was the most advanced speech synthesizer available. It could read almost any text given to it, at an eighty percent accuracy rate, but it cost the enormous sum of $29,000.[221] The Kurzweil

218 Ibid., 59.
219 Bowe, *Personal Computers and Special Needs,* 123.
220 Ibid., 124.
221 Ibid., 112.

Reading Machine was powerful and used by those who could afford it, such as Judge Leonard Suchanek, the highest ranking employee in the federal government with multiple disabilities at this time.[222] Suchanek's office used multiple examples of state-of-the-art assistive technology; in addition to his Kurzweil Reading Machine, the accuracy rate of which he was unsatisfied with, the Judge also used an LED-120 Braille printer from Triformation Systems which could print 120 characters per second and included Duxbury's Braille Translator software for $14,000. His office also used a portable brailler from Maryland Computer Services, the Perkins Brailler, for $3,000.[223] More affordable devices did exist, but with less capability. The Echo II speech synthesizer from Street Electronics was popular and cost only $130; however, one author described the device's speech as sounding “like a robot with Wiener schnitzel stuck in its throat.”[224] Beyond the prohibitive cost of many of these devices, speech synthesizers also carried with them additional problems of not being able to translate any kind of graphics or images into speech, not working well with spreadsheets, and being prevented by computer memory limitations from storing large numbers of individual words. Few off-the-shelf software programs were available that worked with speech synthesizers at all.[225] Blind people who wanted to use their computers with Braille could buy the VersaBraille System to edit and print Braille, for $6,700.[226]

For people with vision impairments, but some ability to see, the fixed size of text displayed by early personal computers caused difficulties. Some specialized software

---

222 Suchanek was blind and was partially hearing impaired.
223 Ibid., 114.
224 McWilliams, *Personal Computers and the Disabled,* 293.
225 Ibid., 88.
226 Ibid., 90.

existed to allow magnification of text and zooming: for example, Large Type, which allowed for typing in large-sized print, or PC-LENS, which could zoom in on portions of an IBM PC screen and worked with both monochrome and color monitors.[227] These kinds of specialized technologies would eventually become unnecessary as software and operating systems adopted zooming and text size options as standard features. The move toward universal design as a more mainstream concept would make such features normal options for users in the following decade. Until there was greater and easier built-in control of computer functionality for users, however, people with disabilities required specialized technologies like these in order to use computers in the ways that worked with their individual needs.

Computer users with speech disabilities were similar to deaf users, in that their disability had little effect on their general computer use, but they could benefit from computer technology in terms of communication. People with speech impediments could use the same speech synthesizers that blind people used, but as a means of communication, instead of as a way to understand computer output. Previously, people who were unable to speak used written messages or point boards (boards with common words, phrases, and symbols that the user could point to) to communicate.[228] Similar to point boards, portable speech synthesizers, which contained a small number of preloaded words and phrases from a computer, allowed people who could not speak to carry a speech output device with them in public. These devices were especially useful for communicating simple instructions over the phone or acquiring help during an emergency

[227] Large Type is described in ibid., 297 and PC-LENS ibid., 300.
[228] Ibid., 63.

(e.g. a button could be programmed to say out loud "I have an emergency, please send help").[229]

Computer users with disabilities affecting their hands and fine motor control needed specialized input devices in order to enter information into a computer and manipulate software. For people who could press standard keyboard keys one at a time, third-party companies developed adaptive keyboards which circumvented multi-key presses (such as control-[some letter] or shift-[some letter]) by treating the control and shift keys similar to caps lock—pressing the key once turns it on until it is pressed again to deactivate it.[230] Computer users who needed only a stabilization aid could use keyguards: simple, plastic boards that covered the keyboard and had holes for individual keys, so that a key could be depressed without neighboring keys accidentally being hit.[231] More complicated input devices were developed for people who could not use a standard keyboard at all. Large, programmable keyboards could be adapted to users with various degrees of motor control and for various kinds of software uses. Computer users who could not operate any kind of keyboard could control a personal computer via any number of switch devices. They were created by various companies and allowed users to operate a computer with a single switch controlled by any possible muscle in the body. A short essay written by a man with ALS on his disability and computer use composed via operating a single switch with one of his eyebrows demonstrated how even the smallest muscle control could allow someone to use a personal computer.[232] Early personal

---

229 Portable speech synthesizers listed by McWilliams ran from $150 (the Vocaid, ibid., 309) to almost $3000 (the Phonic Ear Vois, ibid., 301).

230 Ibid., 81.

231 Bowe, *Personal Computers and Special Needs,* 86.

232 McWilliams, *Personal Computers and the Disabled,* 83-85.

computers could not interact with these kinds of input devices directly, however; an interface card would need to be used for the computer to recognize an adaptive device as something it knew.[233]

People with disabilities did not only benefit from personal computer technology specialized for their specific disabilities. General technological improvements to computer hardware and software could create accessibility, regardless of the intended user. Bowe's argument that personal computers should be made accessible while the technology was still in its infancy, so that barriers did not have to be removed later, was beginning to happen by the mid-1980s. Ideals of what would later be called universal design—creating technologies to work for as many users as possible through flexibility and options to accommodate needs—were slowly spreading through the culture of computer developers. Flexible technologies also held the possibility of unintended uses. Even the simple spell checker or thesaurus already built into word processors had additional uses, in that it could help deaf people learn English.[234] General word processing software could also help people with learning disabilities who struggled with handwriting. According to Bowe, what made computer technology special here was that it allowed for "creative learning" and versatility; it offered different ways for people to learn than traditional educational tools by being adapted to their individual needs.[235] Universality was embedded into the computer as a tool for any purpose. For example, the LOGO computer language, which operated via graphics instead of words, provided a way for people who had trouble with text to write computer programs. For people with motor

233 Bowe, *Personal Computers and Special Needs,* 129.
234 Ibid., 18.
235 Ibid., 62 and 64.

disabilities, the development and expansion of internet services provided a way for computer users to accomplish various tasks, such as shopping or banking, without needing to leave the house. These same services acted as a way to save time for all users, but were especially beneficial for computer users who had difficulties getting around outside their houses.[236] This demonstrates an aspect of accessible everyday technologies I will return to: features which increase usability for all users can also act as assistive technologies for users with certain disabilities—in the same way that a curb cut makes it easier for (almost) everyone to use the sidewalk, but is a necessity for wheelchair users. Usability and accessibility are intertwined; designing for one can allow for the other.

Out of this multitude of technologies being developed by small, third-party companies during the early 1980s, many became standard features of personal computers or a relatively common part of the consumer market for external devices. Personal computer operating systems would absorb many of these technologies, such as zooming, text enlarging, and even text-to-speech and speech-to-text functionality. Most of the small companies that developed these technologies would not last long or be very successful. There were exceptions, however; some of those companies that dealt with technologies for severely disabled people, such as whole computer systems geared toward an individual's use, or those building highly specialized devices whose complexity or limited market value made them unlikely to be taken up by larger companies would find success in niche markets. For mainstream accessibility, however, it would be a number of years before such technologies were standardized and easily available.

The state of accessible computer technology in the first few years of consumer

236 Ibid., 21.

available personal computers was replete with unactualized potential. The computer promised to change people's lives for the better, but for people with disabilities, little attention was paid to them as computer users by major computer companies. The design of personal computers was embedded with assumptions about what kinds of people would be using them, and standards developed as computer technology changed that left people with certain kinds of disabilities unable to use off-the-shelf products easily. Until the mid-to-late 1980s, accessible computer technologies were mostly developed by small companies or individuals seeking solutions to problems friends and family members encountered using the computer. Information for people not working in the computer industry or on the forefront of the technology was difficult to come by. What emerges from the story of the struggle to get accessibility features into personal computers is the insight that in order for technological solutions to benefit users, both technological innovations *and* a social infrastructure which can disseminate them are necessary. The existence of a technology alone is insufficient to cause its uptake by users, without some means by which users can become aware of the technologies and some way to acquire them.

One way to navigate this environment—in which accessible computer technology was being developed but a lack of information or organization kept it from reaching potential users—was for consumers to pool their resources and knowledge and attempt to influence the growth and use of computer technology. Disability and technology activist groups, many started by parents or teachers, helped to create this bridge. They functioned as networks of both technology information and advocacy, encouraging people with disabilities to learn about technologies that might benefit them and developers to focus on the diverse needs of their users. I discuss the formation and work done by one such consumer-based organization, the Disabled Children's Computer Group (DCCG): a local, parent-run disability and technology activist group in Berkeley, California. The DCCG acted as a point of convergence—a place where awareness of the possibility of technology encountered the realities of technological development, knowledge of how to use the technology, and a consumer base informed about the technology. This convergence makes the DCCG a particularly good example of the kind of social infrastructure that is necessary in order for accessible technology to reach users with disabilities.[237]

3.4 Unicorn Engineering and the Brands

The Disabled Children's Computer Group evolved out of a connection with the type of small, third-party accessible technology developer I have discussed. Unicorn Engineering, a company making adaptive keyboards for people with motor disabilities, was a typical very small business developing accessible personal computer technology in the early years. The company, and the man who started it, would go on to play an integral role in the founding of the DCCG. In this section, I describe the technology developed by Unicorn and how its significance would impact the founders of the DCCG into creating the kind of technology and advocacy network needed in order to disseminate knowledge

[237] An activist group is, of course, not the only kind of infrastructure that can get technology to users. Computer companies alone are capable of creating consumer markets and interacting with users. Until the mid-to-late 1980s, however, large computer companies showed little interest in computer users with disabilities as a potential market. In addition, the fast-paced development of computer technologies and multitude of small companies creating specialized technologies has formed an industry where it is particularly difficult to stay on the cusp of innovations.

on personal computer technology and the products themselves to people with disabilities.

In 1979, Steve Gensler, a resident of Oakland, California, started Unicorn Engineering after creating a computer keyboard that could be used by a friend of his who had cerebral palsy. This kind of origin—one technologically proficient person trying to making a computer work for a friend or family member with disabilities—was common among accessible computer technology start-up companies. Gensler taught himself electronics in order to build a keyboard with large, flat buttons that were easy to press and were programmable, so that any key could be told to have the computer respond in any manner. In the 1992 patent application for the successor to this keyboard, engineers from IntelliTools (the company that Unicorn Engineering became in 1991) described what made the Unicorn Board particularly usable by people with disabilities.[238] The patent compares a traditional keyboard to the Unicorn Board; the former requires roughly the same level of dexterity as operating a typewriter, whereas the latter can have “keys” of any desired size and configuration assigned for any function, making it operable by people with varying degrees of motor control. Instead of the individual keys found in a standard keyboard, the Unicorn Board had a flexible membrane covering hundreds of switches. The membrane could be divided into any number of programmed sections that each covered a number of switches.[239] Each section, or “key,” would be labeled by a card that covered the entire membrane. As the labels on the overlay were customizable, they could display whatever symbols, colors, numbers, or words suited the users' needs.[240] When a user pressed anywhere on the overlay within an area assigned to some function,

[238] Michael J Silva et al., Membrane Computer Keyboard and Method. US Patent 5,450,078, filed October 8, 1992, and issued September 12, 1995.
[239] Ibid., 1.
[240] Ibid., 2.

the flexible membrane would activate the switches underneath, and the computer would read the switches.

In 1984, rehabilitation researchers presented a paper at a Closing the Gap conference describing their use of the Unicorn Model 1 Keyboard with their clients with disabilities.[241] Their Unicorn Board could be programmed to have from one to 128 keys that performed different functions. Because the keyboard was this flexible, it could be programmed to optimize the user's interaction with it in operating specific software. That is, only those keys needed to control the desired software, at the size of key the user could best operate, needed to be used; no extraneous keys would then be present that the user might accidentally press.[242] Additionally, the researchers found it advantageous that the most frequently used keys could be programmed to be those most accessible to the user or easy to reach.[243] As with other accessible interface devices at this time, however, the membrane keyboards developed by Unicorn could not communicate directly with the computer; they required a separate interface card that could make the computer understand the input from the keyboard. The interface card would translate a press of the keyboard into information the computer could read; the computer would then think that it was reading input from a standard keyboard.

The benefits the Unicorn Board had for people with certain disabilities brought Steve Gensler and the founders of the DCCG, Jackie and Steve Brand, together prior to their founding of the disability and technology advocacy organization and would help

---

[241] James H. Heller, David Salisbury, and Judith C. Lapadat, "The Unicorn Model 1 Keyboard As a Rehabilitation Tool," in *Computer Technology for the Handicapped: Proceedings from the 1984 Closing The Gap Conference,* ed. Michael Gergen and Dolores Hagen, 68-70 (Henderson, MN: Closing The Gap, 1984).

[242] Ibid., 70.

[243] Ibid., 69.

inspire their creation of social technologies that would connect thousands of disabled people with computer technology to benefit them. Gensler met the Brands when he and Steve Brand both took computer classes to learn more about the technology that might help the people they cared about; Gensler sought to learn enough to build adaptive keyboards and Steve Brand looked for solutions that would enable his daughter to use a personal computer. Gensler's Unicorn Board would become one of the first technologies to offer the Brand's daughter a way to help her communicate and learn.[244] This initial, very personal connection with computer technology would show the Brands the liberatory potential of personal computers.

In 1974, Jackie and Steve Brand, two teachers in the San Francisco Bay area, gave birth to their second daughter, Shoshana.[245] Due to health complications when she was born, Shoshana developed cerebral palsy and vision impairments. As a consequence, she was unable to speak, did not possess fine motor control, and was legally blind. When Shoshana was still a baby, the Brands looked for programs and services in the area that could help them with the difficulties they faced raising a child with disabilities. Jackie Brand sought help from the Center for Independent Living (CIL) in Berkeley. Though the CIL focused on adults with disabilities with little attention paid to parents of children with disabilities, Brand[246] went to work there during the mid-1970s to gain what help and

---

[244] Most of this history of the Brand's personal lives comes from an oral history project Jackie Brand participated in during 1998 and 1999: Jacquelyn Brand, "Parent Advocate for Independent Living, Founder of the Disabled Children's Computer Group and the Alliance for Technology Access," an oral history conducted in 1998-1999 by Denise Sherer Jacobson in *Builders and Sustainers of the Independent Living Movement in Berkeley, Volume V*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2000.

[245] Shoshana Brand later changed her name to Judith, when she was an adult. For the sake of historical accuracy, I refer to her as Shoshana during the time period that that was her name.

[246] When I use only her last name, I am always referring to Jackie Brand.

familiarity with the disability movement that she could.[247] One of the people who inspired her at CIL was Judy Heumann, a prominent leader of the disability rights movement. Heumann influenced Brand with her views on the need for independence of people with disabilities and persuaded her that as a parent she would need to not be overly-protective just because one of her daughters was disabled; Shoshana would need to be given the opportunity to live her own life.[248] This view of people with disabilities living full, independent lives and participating in society as they desired would shape the disability and technology organizations Jackie Brand would go on to create. Seeking ways for Shoshana to live an independent life would lead the Brands to accessible computer technology as a tool that could benefit their daughter. The promise that technology might enable people with disabilities to live in society fully, combined with the complicated and confusing state of accessible computer technology during the late 1970s and early 1980s, pushed the Brands to find their own solutions for their daughter and to join together with other dedicated individuals looking for answers in personal computer technology.

Jackie Brand's first interaction with other parents of children with disabilities was through a local parent support group at the Alameda County Association for the Mentally Retarded.[249] Brand found, however, that few other parents thought about their children in the long-term—as children with disabilities who would grow up to be adults with disabilities. This lack of forethought was evidenced strikingly during the April, 1977 San Francisco sit-in at the Department of Health, Education, and Welfare offices to protest the delay of the signing of the Section 504 regulations. Brand went to the federal building to

---

247 Ibid., 23.
248 Ibid., 27-28.
249 Ibid., 25.

join the sit-in with three other parents she had become close friends with. They were asked by Heumann to try and gather a group of parents and their children with disabilities to protest in front of the building. Calling all the local parents she knew, Brand remembers that most parents were unreceptive, claiming that this protest was not relevant to them, that their children would not grow up to need the protections of legislation such as Section 504.[250] Brand saw a refusal to accept the reality of their children's futures in the position of these parents, that their children would not need civil rights protections because their parents could not imagine them living the kinds of independent lives as adults that Brand and the CIL desired for people with disabilities. This lack of perspective limited the usefulness of parent support groups for Brand; she saw her own views about her daughter's future as too different. It was the few parents of like minds who the Brands would stay close to; this handful of parents desiring independence for their children would become the initial group that formed the DCCG six years later.

Other legislation in the 1970s, however, more immediately affected the parents of children with disabilities. The Education for All Handicapped Children Act of 1975—the beginning of mainstreaming of education for children with disabilities—brought disabled and non-disabled children together into the same classrooms to receive the same education. Brand worked on a Center for Independent Living off-shoot project, called Keys to Introducing Disability in Schools, which developed curriculum with the advice of children and adults with disabilities that would be used in classrooms with both disabled and non-disabled children.[251] The goal of the project was to make both children

---

[250] Ibid., 26.
[251] Ibid., 37.

and teachers comfortable in integrated classrooms. Integrating children with disabilities into regular classrooms was not easy, however, and the Brands ran into problems trying to find a school environment that fit Shoshana's needs. They tried out and struggled with a number of different schools: a mainstreaming elementary school in Berkeley where their daughter was ignored and not taught the same materials as other children, a special education program in the Richmond public schools where Shoshana was taught only with other children with disabilities, but interacted with non-disabled children elsewhere in the school, and a Richmond middle school with a relatively successful, fully mainstreamed program which unfortunately lacked a necessary elevator to have physically accessible classrooms.[252]

Accessible buildings were not the only requirement for Shoshana to be able to learn; the need for other kinds of assistive technology in Shoshana's education introduced Jackie and Steve to personal computer technology and how to make it usable by people with disabilities. The Brands wanted their daughter to be a part of the computer revolution they were witnessing in the early 1980s. They hoped that computers could allow her to learn and communicate in ways that Jackie found other tools did not allow:

> For example, books: she couldn't read the books. For example, the blackboard: she couldn't see the print on the blackboard. For example: pencils and paper: she didn't have the fine motor capacity to write, and so though she had a great interest in the academics of school, the tools weren't right for her. The tools didn't work for her, and we didn't know exactly what would work for her, but here was this, you know, new microcomputer revolution before us with promises that it was going to just revolutionize learning and teaching and the way in which we function in society. And our first thought was, well, why shouldn't these revolutionary new tools work for [Shoshana] in place of some of the tools that were in school that weren't working for her.[253]

[252] Ibid., 45.
[253] Ibid., 52.

The computer opened up possibilities for the Brands that other tools had not allowed; by adapting to Shoshana's own needs and accommodating her disabilities, she could learn and communicate in ways she was otherwise prevented from doing. First though, Jackie and Steve Brands needed to learn about personal computer technology themselves. Steve took a year leave from teaching in order to take classes and learn enough about computer programming and computer hardware to put together a system that Shoshana could use. It was during this time that the Brands met Steve Gensler and were introduced to his fledgling Unicorn Board.

Gensler gave the Brands a very early version of his Unicorn Board to see if they could get it working properly with the Apple II computer they were setting up for Shoshana.[254] Using an interface card that allowed the computer to recognize the keyboard, Steve Brand was able to program the Unicorn Board. One reason the Brands found Unicorn's keyboard so useful for Shoshana was in the way that it was programmable and could be adapted to her needs. The keyboard allowed Jackie and Steve to assess what degree of vision and hand control their daughter possessed. They began by having the computer respond positively—for example, by playing music—to Shoshana touching anywhere on the keyboard at all, as a way to show her that she could control simple cause and effect.[255] The Brands then added colors that they knew Shoshana was able to identify, covering each half of the keyboard overlay with red or yellow and asking her to touch one side or the other. They then divided the keyboard into four colors or

---

254 Mary Lester, "Grant Writer for the Early Center for Independent Living in Berkeley, 1974-1981," an oral history conducted in March, 2000 by Susan O'Hara Jacobson in *Builders and Sustainers of the Independent Living Movement in Berkeley, Volume I*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2000, 114-115.

255 Jacquelyn Brand, "Families Working Together," *The Exceptional Parent,* October 1985, 17-18.

pictures of different animals and asked her to press each by name. The computer would respond to the animals, for example, by making the corresponding noise each animal makes. As Shoshana quickly learned how to use the computer, her parents programmed the Unicorn keyboard to allow her to communicate via text, by having buttons represent sentences of words. It was this feature of ever increasing complexity that allowed Shoshana to learn how to use the computer with the Unicorn Board. Jackie Brand describes the way her daughter learned:

> Eventually the keys got smaller and smaller, there were more and more divisions on that board, until she had essentially a full keyboard to work with. Had we shown her that full keyboard right at the beginning, there was no way she could have done it. She needed to build her ability to distinguish and to move between smaller and smaller distances. That was the developmental thing she needed, and this keyboard uniquely provided that opportunity.[256]

The Unicorn keyboard was powerful because it was adaptable. People with many kinds of disabilities that affected how they might operate a computer keyboard were all able to use this technology by programming it for their individual skill levels. Such a device could make the computer more truly universal by working for people with different kinds of abilities and needs.

However, as great as the potential of assistive technology was to bring the personal computer to people with disabilities, Jackie Brand also realized that these devices were not yet at a point where they were usable for a large audience. The Unicorn Board and other adaptive input devices could not simply be plugged into a computer and work correctly; they required a complicated set-up through an interface card that could translate the input device for the computer:

[256] Brand, "Parent Advocate for Independent Living," 54.

> This keyboard and interface card did a lot of things for a lot of kids and adults who otherwise were really blocked from accessing a computer, so this was the beginning of my understanding about the power of assistive technology. And we also realized that this was not easy stuff to do. It would have to be a lot easier to use before many people would benefit from it.[257]

Accessible computer technology was far from simple or intuitive in the early 1980s; it required a steep learning curve and multiple devices working together in order to use. The Brands found that the computer industry and the technology itself was not yet set up to make accessible technologies readily available. Small companies and entrepreneurs developed adaptive devices that allowed people with various disabilities to use computers, but information on such devices was not readily available and making different interface devices work with early personal computers was not easy.[258] Large computer companies, such as IBM or Apple Computer, produced new innovations quickly as the personal computer developed, but, until the mid-1980s, were not explicitly focused on addressing the needs of people with disabilities.

Dolores Hagen, co-founder of Closing the Gap—a conference and journal on technology in special education—argued that a lack of information was a barrier preventing personal computer technology from reaching more people with disabilities during the early 1980s. She described the rhetoric surrounding personal computers that made the technology sound intimidating and complicated. Misinformation led potential users to believe they needed to have skills in programming or math in order to operate the computer. Marketing by computer companies declaring that anyone could learn to be a

---

[257] Ibid., 55.

[258] One of the finalists in the Johns Hopkins contest created a device that addressed the problem of making different interfaces work with a computer. Paul F. Schwejda's Firmware Card Training Disk allowed a user to plug in any interface device into an Apple II by making the device act like a standard keyboard to the computer.

programmer made the situation worse, by turning people away who might otherwise be interested in computers but felt this perceived requirement to learn programming put the technology beyond their reach.[259] The hobbyist origins of the personal computer in this way worked against its quicker uptake with the general public. Apple, for example, tried to counter the view that the computer required specialized knowledge to use by their use of an everyday, common object, the apple, as their logo and slogans such as, "Simplicity is the ultimate sophistication," in their advertising campaign for the Apple II.[260] Hagen believed the situation was improving by 1984, but she still saw a lack of communication between programmers and teachers, in particular, regarding the needs of special education students and the use of computer technology.[261]

In spite of these difficulties, however, the Brands slowly found personal computer equipment for Shoshana. Unicorn Engineering's programmable keyboard provided one important example of an accessible computer technology that their daughter could use and which could improve her life. They discovered that the computer empowered their daughter to be able to express herself in ways people had always told them she would never be able to. The computer changed the expectations both the Brands and outsiders had of Shoshana. As Jackie relates Shoshana's use of the computer:

> Imagine the whole creative process opening up before you, where there has never been an outlet before. Imagine suddenly being able to express your needs, your desires, when you've never spoken or written a word. That is a drama that makes chills go up your spine.[262]

---

259 Hagen, *Microcomputer Resource Book for Special Education,* 2.

260 Apple Computer, *Simplicity is the ultimate sophistication: Introducing Apple II, the personal computer,* Computer History Museum, http://www.computerhistory.org/brochures/full_record.php?iid=doc-43729572aadaf.

261 Hagen, *Microcomputer Resource Book for Special Education,* 4.

262 Quoted in: Publication. Harvey Pressman. "The National Special Education Alliance: Applying Microcomputer Technology to Benefit Disabled Children and Adults," (Cupertino, CA: The National

The computer made it clear that, although Shoshana could not communicate through traditional means, such as via speech or handwriting, she could in fact communicate; the technology behind her communication just needed to accommodate her abilities. Alongside the Unicorn Board, Shoshana also used a speech synthesizer, the Echo II, from Street Electronics.[263] For the first time, she was able to write out what she wanted to say and use the computer to speak it out loud to others. The Echo II also allowed Shoshana to work more independently, as it could accommodate her vision impairment by reading any text she composed out loud whenever she wanted it to, allowing her to edit her work herself.[264] Brand describes the way these computer technologies made her and her husband rethink what their daughter was capable of: “And all of a sudden, 'She can’t do this,' became, 'Wait a minute. We haven’t found the tool to help her do it yet.' And so it was enormous mental change and shift in attitude to begin to understand just the very tip of the iceberg of what technology might mean.”[265] For the Brands, computer technology became the tool that would enable their daughter to communicate and learn at her full potential. The value embedded in it as a universal tool made it precisely the right tool to be adapted to individual needs.

3.5 The Disabled Children's Computer Group

Desiring to share what they had learned of the possibilities of computer

---

Special Education Alliance, Apple Computer, Inc.), 1987*,* box 1, folder 1, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 9.

263 Jane Ferrell, "Computers help the disabled get an equal chance," *San Francisco Examiner,* Sun, March 24, 1985, D3.

264 Jacquelyn Brand, "Families Working Together," *The Exceptional Parent,* October 1985, 18.

265 Jackie Brand. “Assistive Technology Oral History Project.” Interview with Chauncy Rucker, November 1, 2007, http://atoralhistory.uconn.edu/podcasts/brand.php.

technology for people with disabilities and to combine their efforts with others, Jackie and Steve Brand joined with a handful of other local parents to found the Disabled Children's Computer Group in November 1983. The group met in donated space at the University of California, Berkeley's Lawrence Hall of Science[266] to hold meetings and technology demonstrations. At their first official meeting, this small group of parents was joined by other people interested in people with disabilities and computer technology, such as adults with disabilities, teachers, medical professionals, and people working in technology fields—around fifty people total.[267] The DCCG's location at the Lawrence Hall of Science played a role in the organization's quick growth, according to Brand:

> The Lawrence Hall of Science had a history of providing hand-on science experiences for children, including computer awareness days. In addition to its programming expertise, the Lawrence Hall of Science provided two essentials for any new organization: a place to exist and a way to do mailings. To this day, people active in the DCCG feel that this original alliance between interested parents and an established professional organization has been key to success.[268]

The Lawrence Hall of Science offered the right space for the DCCG, providing a part of the social technology needed to create a network of knowledge transmission about computer technologies for people with disabilities. It also demonstrates the importance of geography and the role played by Berkeley itself in developing such social technologies; the culture of activism and struggle for civil rights embedded in the place of the university and city helped an organization like the DCCG find the support and encouragement it needed to grow. Berkeley was the center of the disability rights movement in the 1970s; the same students with disabilities who fought for access to UC

---

266 The Lawrence Hall of Science is a museum and public science and mathematics education center.

267 Ibid., 56 and Pressman, "The National Special Education Alliance: Applying Microcomputer Technology," 5.

268 Jacquelyn Brand, "The Disabled Children's Computer Group," *The Exceptional Parent,* October 1985, 16.

Berkeley went on to create the Center for Independent Living and inspire Jackie Brand's views on disability and independence. The DCCG was created at this hub for disability and independence. People who worked for the Lawrence Hall of Science, such as Linda DeLucchi and Larry Malone, were among the first members of the DCCG and helped the DCCG to grow, organize, and find funding.[269]

The initial connection between consumers (parents of children with disabilities and adults with disabilities) and professionals (medical and technology professionals) at the group's first meeting would become one of the major values of the DCCG, continuing to the present day. A spokesperson for the DCCG described the reasoning behind this value of combined effort as: “Parents bring an urgency and commitment which is complemented by professionals' experience and resources.”[270] The relationship between consumers and professionals was built in to the foundation of the DCCG and the values of the people who ran the organization; it would frame their work in both connecting disabled computer users with computer technology that could benefit them and in the formation a few years later of the National Special Education Alliance from within Apple Computer, which I discuss in the next chapter.

The DCCG grew initially through word-of-mouth. At the DCCG's creation and for the next few years Jackie Brand worked as the group's Executive Director and Steve Brand as its President. A steering committee was established after the first meeting to plan future meetings and workshops; they would go on to become the DCCG's initial Board of Directors. During the first two years, the DCCG held around five general-

---

[269] Brand, “Parent Advocate for Independent Living,” 56 and 58.
[270] “Developing a Parent / Community Technology Resource Center,” *Closing the Gap*, April 12, 1986, 1.

purpose meetings per year, where DCCG members and other interested people could meet and share their knowledge and resources. Anyone knowledgeable about accessible computer technology was invited to give demonstrations showing the strengths and weaknesses of devices or software.[271] The group also held occasional weekend hands-on workshops, where parents and potential users of computer technology could interact with devices directly to test them out and see what worked best for their individual circumstances.[272] This network of expertise sharing permitted people of various backgrounds to become the experts in the burgeoning technology and share what they had learned with others. Clearly addressing needs in the community beyond only a small group of parents, the DCCG grew quickly. Within two years, the group had 1,000 members. At this point, the size of the organization was large enough that its needs could no longer be served by the Lawrence Hall of Science; by 1985, the DCCG needed a more permanent home.

In September 1985, a local elementary school donated spare classroom space to the DCCG; here, they started their Resource Center, a semi-permanent fixture which could hold meetings and store computer technology. At the Resource Center, the group was able to expand the services and activities they offered. The DCCG continued their technology demonstrations, now conducting regular, personal, hands-on consultations for adults with disabilities, parents of children with disabilities, and disability professionals. Open meetings still took place between community members and professionals, where a wide range of technologies were discussed for people with varying levels of computer

[271] Brand, "Parent Advocate for Independent Living," 56-57.
[272] "Developing a Parent / Community Technology Resource Center," 1.

knowledge. The group also conducted presentations for other organizations, including both special education and family support groups, such as the California Educators for the Physically Handicapped or the Oakland Association of Chinese Parents of the Disabled. Making use of increasingly available online computer technologies, the DCCG ran an electronic bulletin board to better disseminate new information on technologies and events. This kind of telecommunications technology would go on to be an important component of the National Special Education Alliance a few years later. The space allocated to the DCCG at the Resource Center also allowed the group to maintain their own collection of computer hardware and software that could be demonstrated and loaned out to members.[273]

One of the purposes of the Resource Center was to bridge the confusing world of computer technologies for parents who lacked adequate information about what might meet their needs. The DCCG held an annual Family Workshop where families could learn about available accessible computer technologies and discover what worked best for them. Brand describes serving this need for local families:

> As many people will testify, it is difficult enough to get clear, understandable answers to questions about how and what to buy when there are no specialized needs or adaptations necessary. When there are, and one is uncertain about what might work, there is almost no commercial establishment able to give adequate information about special education needs. For those families who think their daughter or son might benefit from a computer, but do not know which kind or what adaptations are necessary, the DCCG Family Workshop offers an important first step.[274]

The DCCG here acted as a social technology where consumers could learn about what might benefit them.

---

[273] Pressman, "The National Special Education Alliance: Applying Microcomputer Technology," 5-6.
[274] Brand, "Families Working Together," 17.

The Family Workshops also provided an opportunity for children with disabilities to be the experts, sharing their computer experiences with other families. Brand explains that this was an uncommon role reversal for many children with disabilities, as they were usually the ones receiving help, instead of being in positions to share their expertise. She describes the variety of technologies these children showed off, "including large print screens, braille embossers, software for talking Apple Computers, left hand only keyboards, single switch computer controls, computers for non vocal individuals, and robots."[275] Knowledge of these cutting edge technologies not only demonstrated that these children with disabilities were capable of mastering complicated technology, but could teach its use to others. The consumer/professional partnership behind the DCCG also played a role in the Family Workshops; technology developers would bring their products to demonstrate and allow users to try out. This was not a one-way exchange, however, as consumers also provided feedback to developers about what was working for them or could be improved, and which of their needs were not yet being met.[276] This was an environment of problem solving, reminiscent of the kinds of hobbyist tinkering with personal computers that had helped start the personal computer industry roughly a decade earlier.

While the DCCG was quickly growing during the mid-1980s, Unicorn Engineering was also finding success, partly in connection with the DCCG. During the winter of 1984-1985, Arjan Khalsa, a teacher in the Bay Area, became interested in accessible computer technology. Khalsa had recently attended a class on

---

[275] Ibid., 18.
[276] Ibid., 17.

mainstreaming special education students in the Berkeley area and was struck by the role technology played in accommodating disabilities, as well as the obstacles technology created when it was not designed to be accessible. Shortly thereafter, Khalsa happened to catch a radio program discussing McWilliams's book on computers and people with disabilities; Khalsa quickly contacted the author for more information. McWilliams directed Khalsa to the DCCG, where he met Gensler; moved by the meeting he attended there, Khalsa threw himself into working with disabilities and computer technology.[277] Khalsa soon partnered with Gensler, eventually becoming the CEO of IntelliTools after it replaced Unicorn Engineering. Khalsa also became a long-standing member of the DCCG's board of directors, helping to shape the direction the organization went in for years. Unicorn Engineering would also continue its ties with the DCCG; Unicorn Board users held regular meetings and conducted seminars for people new to the technology at the DCCG into the 1990s.[278] The DCCG provided a space where developers and users could directly interact and share their knowledge of the technology with others.

3.6 Computer Companies and Accessibility in the 1980s

The story of Unicorn Engineering was not typical of small accessible technology companies during the early 1980s; most other companies were unable to steer their technological innovations into viable, independent businesses. While there were many

---

277 Jack Kenny, "Bridging the sensory divide." *TES Magazine.* (Oct. 16, 1998), accessed 11/2010, http://www.tes.co.uk/article.aspx?storycode=79600.

278 Calendars. DCCG event calendars, May-June 1989 and Nov-Dec 1991, box 1, folder 7, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley.

different small companies making accessible computer technologies in the mid-1980s, most were unable to make enough money to remain viable. Many small businesses could not operate at a large enough scale to create products at a cost that consumers could afford. Jackie Brand describes the situation she observed during the early years of the personal computer:

> Some of the earliest assistive technology companies developed out of human need—one single need that was addressed, a solution that was developed, and the desire of the developers and the designers to make those solutions available to other people—trying to make a go of creating a business and so on. Most of those companies didn't last, and so a great solution would be around but they didn't have the resources to market those solutions, to produce those solutions in enough quantity to bring prices down, and so they were very expensive solutions that very, very few could afford. Eventually most of these companies just went out of business.[279]

Companies such as Unicorn Engineering were the exception in finding success while remaining fairly small.[280]

What small companies did have that large computer companies lacked was the enthusiasm to develop accessible computer technologies. Through the mid-1980s, large computer companies showed little interest in developing their own accessible technologies. One third-party adaptive device manufacturer—Ken Yankelevitz, an aerospace engineer—built accessible game controllers for Atari computers, so that his quadriplegic friends could play games. Yankelevitz took his controllers directly to Atari, in the hopes that they would be interested in selling them. Atari declined, instead opting to refer any inquiries about accessible game controllers to Yankelevitz's KY

279 Brand, "Parent Advocate for Independent Living," 58.

280 Street Electronics was bought by another company. Telesensory was bought then declared bankruptcy. Kurzweil sold his company to Xerox; it became Nuance, which makes Dragon NaturallySpeaking. Words+ was bought by Simulations Plus.

Enterprises.[281] Declining the opportunity to create accessible technologies for their users shows the lack of a viable market large computer companies perceived in people with disabilities. It made more financial sense to these companies to allow third-parties to create devices and software to work with their technologies.

Slowly, however, large companies began to create their own programs focused on accessibility in the mid to late-1980s; though it would still be a number of years before they would do so to appeal to the disability market, rather than out of charity or goodwill. One reason was the growing attention paid to the issue by disability professionals, academics, and the government. The U.S. Department of Education put together a meeting at the White House in February, 1984 for computer company representatives and disability professionals to discuss how personal computers could be made accessible for more people with disabilities. The University of Wisconsin-Madison Trace Center helped coordinate the meeting and published the results. The goal of this meeting was to inform computer companies about issues of accessibility and recruit their support to address the problems people with disabilities faced in using personal computers. The task force provided suggestions to computer companies that they determined would be reasonable to implement and which would make public computers usable by more people. The main conclusion of the group was that access points should be readily available; that is, public computers should have accessible ports where a user can plug in their adaptive devices.[282] A user would carry whatever specific technology they needed with them and could then

---

281 McWilliams, *Personal Computers and the Disabled,* 49. KY Enterprises still exists today and Yankelevitz continues to build accessible game controllers for quadriplegic people playing on modern game consoles. See http://quadcontrol.com/.

282 Gregg C. Vanderheiden, *White Paper: Access to Standard Computers, Software, and Information Systems by Persons with Disabilities,* Version 2.0 (Madison, WI: Trace Research and Development Center, 1985), 17, http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED280257.

plug it into any computer to use it. By building in such a degree of flexibility, any computer could accommodate many different embodied uses. This concept demonstrates the growing value of designing technology to be universally usable; access points would allow anyone access to a computer, but still required that users bring all adaptive devices with them, instead of having the computer accommodate different kinds of use directly. This initial meeting, which then recurred every year after, began a formal dialogue between the computer industry and disability professionals—transmitting the knowledge necessary to make developers aware of the different needs of their users and to accommodate those needs as best as possible. Turning to the results of such efforts, I examine the work of IBM and Apple Computer to create in-house accessibility initiatives, comparing the ways two very different companies—with distinct histories creating personal computers and corporate values—both became involved with promoting and developing personal computer technology for people with disabilities.

3.6.1 IBM and Personal Computer Accessibility

Through the middle of the twentieth century, rival computer companies saw IBM as holding a monopoly on the computer technology industry and thereby controlling innovation. The company had a long history of production strategies where all components of a given system were produced in-house in order to stifle competition.[283] While this would change dramatically with the development of the personal computer, it would still influence the way the company tackled accessibility issues. Accessibility at

---

283 A successful example of IBM's dominance over innovation was in the lack of change in punchcard technology between the 1930s and 1960s. Ceruzzi, page 111.

IBM was done in-house and focused on employees with disabilities. These efforts sometimes replicated accessible technologies that already existed from third-party companies, but also involved new innovations. IBM's computer industry domination led to a Justice Department anti-trust lawsuit in 1969. Twelve years later, the lawsuit was dropped, as the advent of the personal computer had changed the industry to such an extent that IBM could no longer be seen to be impeding competition, and the accusation of a monopoly was found to be "without merit."[284] Compared to Apple Computer, IBM entered the personal computer business relatively late; it was not until 1981 that the company sold its first personal computer—taking the name of the Personal Computer (PC) for its technology. Due to IBM's power in the computer industry, the IBM PC became an instant success among business-workers, far beyond what IBM had anticipated. During the years after its release, fifty million computers had been installed using some version of the PC architecture and running MS-DOS.[285] IBM became the "Big Brother" of personal computer companies that companies created from within the counterculture, such as Apple, fought against, most explicitly in Apple's "1984" Macintosh TV ad. For Apple, IBM represented an old-fashioned way of viewing computers that needed to change, one where the computer was cold, inhuman, and impersonal—the opposite of a convivial technology that had the possibility to be a tool for any imagined use.

Despite seeming untoppable, IBM made certain decisions in how they produced the PC that led to their losing dominance of the personal computer market.[286] The

[284] Ceruzzi, *A History of Modern Computing,* 171.
[285] Ibid., 272.
[286] Ibid., 252.

company rushed to manufacture the PC in a far shorter time than it usually developed products; IBM accomplished this time crunch by incorporating parts manufactured by other companies—instead of developing all aspects of the computer hardware and software internally, as they had with previous computers—thus creating an environment where IBM-compatible computers could come into being. These machines were produced by third-party companies from reverse-engineered IBM specifications and followed IBM's own standards, so that they could run the same hardware peripherals and software that IBM designed the PC to use. The compatibles were not only cheaper than IBM's own computers, but were so easily available that the market became saturated with many different companies all selling similar machines. In addition, Microsoft had retained the right to sell MS-DOS to companies other than just IBM, allowing its operating system to quickly flood the market. IBM-compatible personal computers soon occupied the vast majority of the personal computer market.[287] IBM itself, however, only controlled a small part of the market that they had created; by 1991, companies such as Compaq and Dell made more of a profit with their IBM-compatible personal computers than IBM itself.[288] IBM experienced annual losses for the first time in the company's history for three years during the early 1990s.[289] The successor to the PC, IBM's Personal System/2 (PS/2), was released in 1987 and was IBM's first personal computer with a graphical user interface, running either Operating System/2 (OS/2)[290]—a collaboration between IBM and Microsoft—or Microsoft Windows. The PC and the PS/2 were IBM's main personal

---

[287] Ibid., 277-278.
[288] Ibid., 279.
[289] Ibid., 304 and Jeffrey R. Yost, *The Computer Industry,* (Westport, CT: Greenwood Press, 2005), 183.
[290] OS/2 was not initially a GUI operating system; the graphical interface came with OS/2 version 1.1, released in 1988.

computer products during the 1980s and 1990s, and these were where the company's accessibility efforts were directed during this time.

With their first personal computers released in the 1980s, IBM began to work toward the development of products that kept accessibility for people with disabilities in mind. IBM developed its own accessibility products and features internally, in addition to setting up means to communicate directly with users with disabilities and activist groups representing them. IBM organized its efforts through three programs within the company: the National Support Center for Persons with Disabilities, Special Needs Programs, and Special Needs Systems. Each group was located in a different part of the U.S. and focused on different, though overlapping, aspects of developing accessible computer technologies and getting them into the hands of people with disabilities. This division allowed IBM to target their efforts in three areas: communicating with users, organizing efforts to develop accessibility, and creating accessible products.

IBM's National Support Center for Persons with Disabilities was founded in 1986, in Atlanta, GA; its main activity was to connect people with disabilities with computer technology that could benefit them. The National Support Center communicated with medical professionals, disability agencies, employers of people with disabilities, educators, and individuals with disabilities. Similar to the DCCG's Resource Center, IBM had an equipment demonstration area where people could try out new technologies. IBM would not prescribe specific third-party technologies to people, but provided information on what technologies existed and how people could acquire them. National Support Center employees presented at national conferences in order to promote the development of accessible technologies. The Center also ran an electronic bulletin board that offered information on IBM-compatible technologies, hosted special interest group forums for users to communicate with each other, and provided various files and software for download.[291] In addition to these methods of connecting people with various technologies, the Center also providing marketing and technical support for three IBM products I will discuss in the next chapter: Screen Reader, PhoneCommunicator, and SpeechViewer.[292] The Center reflected its place within a massive corporation, being utilized by thousands of people with disabilities looking for the information and services it offered. It maintained a database that included 500 third-party technology vendors and 850 external disability support groups. In 1989 alone, the National Support Center handled more than 24,000 requests from people with disabilities and interested parties.[293]

In addition to the National Support Center, IBM's Special Needs Programs, out of Somers, NY, was tasked with reviewing the design of products for their accessibility features and managing research projects. The group began in an early form in 1979, to fund research and manage development projects which would lead to consumer products for people with disabilities.[294] Bob Bettendorf, the coordinator for Special Needs Programs, explained, in a 1988 *Think* article, why IBM's organizational divisions were necessary in order to better develop technologies for people with disabilities. He argued that developers might come up with good ideas for new technologies, but without

---

291 IBM National Support Center for Persons with Disabilities. *Technology for Persons with Disabilities,* 16. This booklet was one of the files available for users to download from the bulletin board.

292 IBM National Support Center for Persons with Disabilities. *Technology for Persons with Disabilities*, preface.

293 "National Support Center; a Service of IBM," *The Exceptional Parent*, *8th Annual Computer Technology Directory,* Nov 1, 1990, 2.

294 Spechler, *Reasonable Accommodation,* 129.

connections with marketing, these projects would fail, due to a lack of fit with users' needs or an inability to sell the product to users who could benefit from it. By coordinating and managing efforts through Special Needs Programs, IBM hoped to avoid such past failures. According to Bettendorf, “We're taking the enthusiasm of employees who are personally committed and coupling that enthusiasm with appropriate development and business disciplines. Our goal is to have a steady stream of successful products for people with disabilities.”[295] Once Special Needs Programs found worthwhile research projects, the ideas could then be developed into products that would be both sellable and usable.

The third IBM organizational group devoted to technology for people with disabilities was the Special Needs Systems, founded in December, 1986. The group ran out of Boca Raton, FL and was tasked with overseeing the development of IBM computer products intended for people with disabilities. The line of IBM products developed through the Special Needs Systems group during the late 1980s and early 1990s was called the Independence Series. The goal of the Independence Series was “To enhance the quality of life and employability of persons with disabilities through the use of IBM technology.”[296] By 1996, there were ten products in the Series, including IBM's popular Screen Reader, as well as programs to add accessibility features to DOS, allow phone communication for deaf people, aid therapists working with people with cognitive disabilities, and provide speech controls for a personal computer. I explore the history of some of these technologies and how IBM came to develop and market them to consumers

295 Kafer, "A Fair Chance," 44.

296 "IBM Independence Series" brochure, included with IBM National Support Center for Persons with Disabilities, *Technology for Persons with Disabilities: An Introduction*.

with disabilities in my next chapter.

IBM's organizational structure allowed the company to focus its efforts on three different approaches to personal computer accessibility independently and cooperatively. In addition to encouraging the creation of their own accessible technologies and marketing them to consumers, IBM also developed its own network of ways to interact with users. IBM was not an advocacy organization, but the company did understand that both its own employees with disabilities needed technologies that would allow them to use IBM computers and that public consumers could also benefit from these same technologies. In the next chapter, I will detail some of the accessible personal computer technologies that IBM created, initially for its employees, but then marketed them as consumer products. In addition, I will discuss the ways IBM began to work closely with activist groups during the late 1980s and early 1990s.

3.6.2 Apple Computer's Office of Special Education and Rehabilitation

As with IBM, Apple Computer dedicated resources to promoting personal computer technology for people with disabilities during the 1980s; being a far smaller company and emerging within the activist and hobbyist milieu of the Bay Area, Apple approached computer accessibility in a more localized fashion. Apple Computer was founded in 1976 by Steve Jobs and Stephen Wozniak, with the creation and sale of the Apple II. The company was a descendent of both counterculture values and hobbyist tinkering. While engaged in a quest to design personal computers to be more friendly and usable for everyone, Apple also made design decisions which inadvertently created obstacles for people with certain kinds of disabilities. Prior to 1985 and the creation of their own internal disability group, Apple was not explicitly responding to the needs of their users with disabilities. The Apple II, built from a brilliant and minimalist design by Wozniak, was the first highly successful complete personal computer available to consumers. Its open design and ease of adding peripherals made it popular with people looking to make personal computer technology work for people with disabilities, though its creation at the beginning of personal computer development made it difficult to use in many ways. With the plethora of personal computers available by the mid-1980s, consumers bought whichever machine would run the software they needed to use.[297] As many third-party software developers wrote their programs for the Apple II, it was the computer most widely used by people with disabilities. One of the reasons so many software options existed for the Apple II was that it was designed to be both flexible to write programs for and without interface standards. The result was that consumers had to choose between a large number of software applications; some were user-friendly, others not, but all had different features and were operated in different ways.[298]

The Apple Macintosh, released in 1984, changed the experiences of all users and in particular, for users with disabilities. The Macintosh brought a new personal computer paradigm to consumers—one where every application looked the same and was controlled the same way, with the same menus and keyboard shortcuts. This standardization made the Macintosh more reliable to use—a user would not have to learn an entirely new interface for each program—but third-party developers had to follow the

---

[297] McWilliams, *Personal Computers and the Disabled,* 129.

[298] Steven Levy, *Insanely Great: The Life and Times of Macintosh, the Computer That Changed Everything* (New York: Penguin Books, 1994), 134.

Macintosh interface rules in order to write software for it.[299] The Macintosh began with the vision of a man who wanted to enable users to do whatever they might desire with the personal computer; Jef Raskin, the initial head of the Macintosh project and the person who coined its name (after his favorite type of apple), sought to create a computer that would be user-friendly, with an interface designed to be easy and intuitive to use.[300] By 1981, clashes within the company drove Raskin out of Apple, but some of his vision of a truly friendly computer made it into the Macintosh.[301] Frank Bowe predicted that the ability of the Macintosh operating system to allow multiple programs to run at the same time would be particularly useful. Older personal computers could only run one program at a time, which created usability problems when multiple necessary functions were not available in the same program (e.g. needing to calculate the solution to a math problem for a document being written). People with disabilities were particularly impacted by the difficulty and length of time it took to close one program, insert another disk, open up another program, run whatever was desired, then return to the first program. The Macintosh allowed concurrently running programs to be interrupted and switched between easily via the keyboard or mouse.[302] This specific user-friendly operating system design would benefit all computer users and demonstrated the perspective on design and technology that Apple aspired to. This kind of increase in usability—by also increasing flexibility for the user—allowed the personal computer to also be more accessible for people who needed to use it in different ways.

However, not all interface changes brought by the Macintosh benefited all users.

[299] Ibid., 137.
[300] Ibid., 109.
[301] Ibid., 121.
[302] Bowe, *Personal Computers and Special Needs,* 85.

The ideal of personal computers enabling people carried with it a certain image of who its users might be; a number of Macintosh design decisions made its use simpler for some people, but restricted options for people with certain disabilities. For example, the Macintosh as it was initially released did not have cursor (arrow) keys on the keyboard. Computer journalist Steven Levy explains that Steve Jobs decided to remove the cursor keys in order to force computer users to adjust to navigating with the mouse. A Macintosh marketing representative, Joanna Hoffman explained that the lack of cursor keys was also a way to force third-party software developers to create new applications for the Macintosh, which needed the mouse, instead of adapting old ones, which would have used cursor keys.[303]

This kind of design decision restricted the options available to the users, in the name of requiring them to learn a new technology Apple deemed better for them. The company feared that users would not latch onto such a large change as the mouse, and would instead fall back on what they were comfortable with. Apple had much at stake in the success of the mouse—it was one of the most visible innovations that immediately stood out with the Macintosh—and also believed that it was a superior input device for the computer. For most users, the mouse likely was the best input device to control the computer; the mouse has been described as being as intuitive to move the cursor as a steering wheel is to drive a car. However, for anyone who might have found pushing a key easier than controlling a mouse, an off-the-shelf Macintosh would come with new impediments. Apple later relaxed these restrictions on user navigation choice; the Macintosh Plus released two years after the original Macintosh returned the cursor keys

303 Levy, *Insanely Great,* 194.

to the keyboard.[304] In this case, by not imagining people with disabilities as possible users, Apple did not take into account the requirements of different embodied uses; by decreasing flexibility, the Macintosh was made less usable for people who needed different ways to operate the computer. This kind of black-boxing of the computer demonstrates a different perspective on meeting users' needs than the underlying values of universal design. Apple attempted to increase user-friendliness by making the computer simpler to use, with fewer options, whereas trying to make the computer work for all users would involve providing for various needs by making the technology more flexible, though it might add complexity.

While Apple stumbled over accessibility issues with some aspects of their computer development, the company also made a concerted effort in the mid-1980s to address the needs of people with disabilities by creating their own internal group dedicated to such issues. In July 1985, Alan Brightman started the Office of Special Education and Rehabilitation at Apple Computer.[305] A former disability activist in the Boston area, Brightman was invited to Apple, in 1984, by a friend of his who worked there. He was offered a job as a part of Apple's Education Foundation, a group dedicated to giving grants to schools in need. Frustrated by the fact that Apple marketed itself as caring about individuals, yet lacked any explicit focus on people with disabilities, Brightman sent a short proposal to Steve Jobs and John Sculley. They responded positively; Brightman discusses his meeting with Sculley about creating the Office of Special Education and Rehabilitation:

---

304 Ibid., 223.

305 Most of the details of Brightman's history here come from an oral history interview he participated in, in 2008: Alan Brightman, “Assistive Technology Oral History Project,” interview with Chauncy Rucker, March 13, 2008, http://atoralhistory.uconn.edu/podcasts/Brightman.php.

> [Sculley] said, “I don’t know if you’re going to be able to pull this off or not, but you have to make me one promise.” He went on to say… “you have to promise me that if you fail at this, you will fail huge.” And to this day, that was the best permission I ever got to go for something and that was the beauty of Apple at that time. Apple wasn’t about making little waves; it was about making big waves and John didn’t want it to be any different in this domain as well.[306]

Sculley giving Brightman the go-ahead to try something huge in order to better include users who were being ignored harkened back to the values Apple was founded on, within the hobbyist and counterculture history of the Bay Area: of computers as tools for any purpose, that could enable people to think and create in new ways. Believing in the personal computer as a universal tool that can augment abilities and enable people allows for a vision of multiple possible uses and multiple possible users; by designing the computer for different uses, people with disabilities are not forgotten as imagined users.

Brightman was now in charge of accessibility issues at Apple Computer, and for a while, the sole employee of OSER. In order to make the kind of waves he wanted to for people with disabilities, Brightman knew that Apple's own computers would need to be made accessible, particularly the Macintosh. Brightman describes the Macintosh as “never designed with accessibility in mind.”[307] It was more difficult to plug-in third-party devices than the Apple II, as the case on the latter was simple to remove whereas the Macintosh was designed with the intention that its users would not remove the casing. In addition, although the new operating system interface was a radical step forward in usability for most people, its new rigorous standards made it so that adaptive software written for the Apple II could not be ported over. Most of the accessibility problems with the Macintosh came from the deliberate black-boxing Apple had built into this computer.

---

[306] Ibid.
[307] Ibid.

It was, literally, a closed system, not designed to be opened up and tinkered with the way their earlier computers had been. Apple's goal in doing so was to restrict users for their own good; in the name of user-friendliness, a computer that was harder to mess around with would also be harder to mess up. However, this user-friendly black box made it more difficult for users whose needs had not been built into it to make the changes to the computer to accommodate their needs. Apple had emphasized the user-friendliness of the Macintosh without realizing that restricting users' options would also restrict who the user could be.

In order for Apple's engineers to realize the scope of the accessibility obstacles they had inadvertently created, they had to experience a personal demonstration of the problems. At a meeting with Apple engineers in 1985, Brightman demonstrated the problems the Macintosh created for computer users with disabilities. Brightman recounts challenging the engineers to operate a Macintosh and type a memo, using only a pencil held in their teeth, in order to simulate the experiences of a user with severe motor disabilities. The engineers became frustrated by the difficulties in turning on the computer (the power switch was located in the back), loading a disk into the drive, and using a word processor that required multiple keys to be held down at the same time for certain commands. One example, much beloved by Brightman, of how easy some of these problems were to fix concerned the beeping noise the computer made in response to user errors. This feature acted as an impediment for deaf and hard of hearing users, who had no way of knowing the computer was beeping at them. Once made aware of the problem, Macintosh engineers quickly added a visual flash as an error response when the computer's sound was turned down all the way, thus having error options available via sound or sight for users with different needs.[308]

While not all accessibility features are so easy or even doable, many fixes for the Macintosh were this straightforward; all that was needed was an understanding that there was a problem. As recounted by Brightman:

> Sixty-three features that afternoon in about three hours were identified; that while they were conveniences to most users, were actually inconveniences or obstacles to different users with disabilities.... The lesson there was that most of the accessibility problems were easy to solve; they were not complicated issues. What was hard was knowing that there was a problem, and being reminded that not everyone uses a computer the way you do.[309]

OSER's goal of building in accessibility features to Apple's computers fit with the company's values of creating user-friendly computers for individuals. In addition to the small changes to the Macintosh that made it far more useful for people with disabilities, Apple also advertised the idea that computers can enable people and make the world more accessible in its public relations materials.

In the fall of 1986, Apple released a public relations video, called “Access,” presenting their views on accessible technology and the possibilities for computer users with disabilities, utilizing the metaphor of the curb cut. Filled with examples of adaptive technology that allowed computer users with disabilities to communicate, play games, and learn, the video concludes with a segment where a cartoon wheelchair (similar to the graphic used to represent disabled parking) travels across a street. Upon reaching the opposite sidewalk, the wheelchair bumps into the curb and is unable to continue, as the

---

308 Diane Divoky, "Apple Sponsors a New Alliance for Disabled Computer Users," Classroom Computer Learning, October 1987, 46-49.

309 Brightman, “Assistive Technology Oral History Project.”

sidewalk lacks a curb cut. A cartoon construction worker then builds a curb cut, which the wheelchair is able to use to travel up and onto the sidewalk. Following the wheelchair are a number of actual people (not cartoons) using the curb cut to fulfill a variety of needs (for example, a parent pushing a stroller, someone using a dolly to transport heavy goods, a child on a skateboard, a bicyclist, a shopper pushing a shopping cart, people using roller skates, and even a unicycle). This image of a physical curb cut that meets the needs of many different people is then compared to a personal computer. In the video, the cartoon wheelchair is shown encountering a staircase made of bricks, which it is unable to ascend. The staircase transforms into an Apple computer. The computer keyboard is shaped like a ramp that the wheelchair is able to travel up and then into the computer screen.[310] Apple is showing the personal computer itself to be similar to a curb cut, which can be used to accomplish tasks that otherwise present barriers to people with disabilities.

As with the DCCG's perspective on the value of computers for people with disabilities, Apple claims the computer offers independence and the ability for people with disabilities to fulfill their desires. Apple is also making an argument that accessible technology benefits everyone; when something is accessible to people with disabilities, it is more usable to users as a whole. By designing a technology with people who will need to use it in varied ways in mind, usability as a whole is increased. These technologies then allow for uses which are not strictly necessary, but beneficial in other ways, such as convenience. An early personal computer example of this was seen in the previous chapter with computerized conferencing. By developing the technology with people with disabilities in mind, Murray Turoff and his fellow researchers designed a communication

[310] Video cassette. *Access.* (Created by Apple Special Education), VHS, 10:45, 1986.

system that could both accommodate disabilities and be useful to everyone.

The separate work on disabilities and technology done at Apple Computer and the DCCG would converge in 1985. That fall, Jackie Brand and Alan Brightman met at a Closing the Gap conference focused on technology in special education. The conference drew many technology developers, who showcased products still in development. That year, Brightman gave the keynote speech, on advice for special education teachers introducing computers into their classrooms; one of his main recommendations was that teachers and parents should talk about what they needed, and the computer industry should listen.[311] After his talk, Brand felt that he would be interested in the work they were doing at the DCCG.[312] Brand and Brightman found themselves at like minds regarding accessible computer technology; shortly after, Brightman visited the DCCG, and Jackie and Steve Brand visited Apple World. The DCCG and OSER came together at a meeting in February 1986 at Apple, where the DCCG and other disability experts presented to Apple's Education Sales Representatives and engineers on the technological needs of people with disabilities. Fifteen guests and fifteen Apple employees met to discuss and improve Apple's ability to meet those needs.[313] Apple paid the DCCG $500 for giving this presentation and subsequently donated a Macintosh 512 computer to the DCCG.[314] After this meeting, Brightman described the DCCG:

---

[311] Alan Brightman, "Microcomputers and Special Education: Lessons from Unreasonable People," in *Computer Technology for the Handicapped: Proceedings from the 1985 Closing The Gap Conference,* eds. Michael Gergen and Dolores Hagen (Henderson, MN: Closing The Gap, 1985), 1-6.

[312] Brand, "Parent Advocate for Independent Living," 60.

[313] Meeting notes. DCCG Steering Committee and Board Meeting, 1/23/86, box 1, folder 3, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley. I believe this is the same meeting where Brightman demonstrated the accessibility problems with the Macintosh to its engineers.

[314] Correspondence. Alan Brightman to Jackie Brand, 3/7/86, box 1, folder 4, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley.

> The only thing wrong with them is there aren't more of them around the country. My only fear is that they're going to run out of energy. I think of them as some of the best professional colleagues that I have.[315]

This initial collaboration would continue, to both Apple and the DCCG's mutual benefit. Apple debuted their “Access” video at a DCCG Open House a year later. Around this time, Apple and the DCCG would begin a collaboration in earnest that I discuss in the next chapter, as Jackie Brand joined with Alan Brightman to create the National Special Education Alliance.

By the mid-1980s, the field of accessible personal computer technology—begun with innovators tinkering and searching for technological solutions for people with disabilities they knew—was expanding. A large number of small, third-party companies were developing software applications and adaptive devices that enabled computer users with disabilities to make their home computers accessible. The available technology, however, was both difficult to learn about and complicated to make work together correctly. Disability and technology advocacy groups, such as the DCCG, worked to disseminate information on available accessible technologies and to communicate the needs of users to developers. Large, mass-market computer companies were beginning to focus on issues of accessibility themselves, both within their companies and through a national task force. As developers became aware of the different ways people needed to use their technology, they made small changes that increased accessibility for people with disabilities. In my next chapter, some of these organizations and actors come together to create a national umbrella organization to coordinate local activist groups and work with

[315] Quoted in Alvaro Delgado, "Computers + disabled = hope," *West County Times*, May 22, 1986, 1B.

the computer industry in further developing accessible computer technology and reaching potential users; the National Special Education Alliance would be the result.

Chapter 4

Building the Network: Corporate Philanthropy and The National Special Education Alliance

Large, mass-market personal computer companies, such as Apple and IBM, began to build accessibility features into their computers in the mid-1980s, as disability advocates pushed for such features to be a part of computer hardware and software before standardization had built in barriers to accessibility. With the technology now coming into being, advocates within Apple Computer's Office of Special Education and Rehabilitation (OSER) shifted their focus to spreading the word about both the possibilities and realities of personal computer technology for people with disabilities. The technology was being developed; now, it needed to reach users on a national scale. Apple's strategy to evangelize and promote accessible computer technology involved working with locally-based disability and technology advocacy groups, starting with the Disabled Children's Computer Group (DCCG); together, they created the National Special Education Alliance (NSEA)—a national, umbrella organization that could connect together local groups through a network of shared expertise. The NSEA functioned as a nationwide example of the kind of necessary social technology I discussed in chapter 3.

Apple's interests in founding the NSEA were based more in corporate philanthropy than in capturing people with disabilities as a consumer market. Apple was not unique here; at this time, focusing attention on people with disabilities was mostly a philanthropic gesture for computer companies. People with disabilities were not conceived as a potentially profitable market, but, as accessible technologies were needed for them to use personal computers and increased usability could benefit everyone, companies dedicated resources to accessibility. General increased usability made computers more user-friendly—broadening the userbase to include people who were unsure of the technology. Employees within computer companies, some disabled themselves, believed that personal computers could specifically help people with disabilities, but in order to do so, consumers and developers needed to be made aware of what was possible. However, the personal computer revolution created an environment where new, better technologies were continually being developed and released to consumers at a pace that made knowledge transmission difficult. Furthermore, this difficulty was compounded by the inherent complexity of these technologies—both in technical terms and as part of a cultural perception of computers as high technology that required certain kinds of intelligence or abilities to operate. Organizations like the NSEA and DCCG sought to combat this perception of computers as complex technology by communicating knowledge and skills between producers and consumers. Similar to Apple's methods, IBM, while developing their own accessible technologies, also worked to get computer technologies into the hands of users through philanthropic programs to communicate knowledge of the technology to people with disabilities.

In this chapter, I begin my account of corporate accessibility-related philanthropy and the formation of a national network of disability and technology groups with the creation of the NSEA, from three different perspectives: Apple Computer, the disability and technology advocacy groups that joined the Alliance, and the third-party technology vendors that Apple brought in. Next, I turn to an examination of the limits of Apple's corporate philanthropy with the separation of the NSEA from Apple, as the NSEA became an independent, non-profit organization and transitioned into Alliance for Technology Access (ATA).[316] I also discuss the activities of the DCCG during the late 1980s and early 1990s, as it continued its local, on-the-ground activism in the Berkeley area after the Brands moved on. I conclude by examining the internal accessibility work done by IBM during the late 1980s, which consisted of efforts to both distribute computer technology to users and develop accessible technologies for employees and consumers.

4.1 Creation of the NSEA

In the spring of 1986, Jackie Brand and Alan Brightman began to discuss the idea of a national organization that could connect together local disability and technology groups such as the DCCG. Brand felt that work being done around the country by local organizations was being held back by their lack of connection to each other.

> One of the things that we saw early on was that there were little efforts taking place all over the world, probably—but to our knowledge, all over the continent—where somebody with a disability had a need and they or a family member or a friend were trying to address the need and create a solution. Those solutions were kind of mom-and-pop type solutions and they never became part of the mainstream, so other people didn't have access to those solutions. The field was only going to grow and be effective if we could connect people who were working together in the field.

[316] I use the names NSEA or ATA depending on the historical time I am discussing. I also use the term Alliance to refer to the organization in general, as this nickname was used throughout the group's history.

> That was our goal: to have people not feel isolated just trying to resolve the same problem in various parts of the country, but instead to learn how to share solutions together and have the resources to build on each other's successes rather than having to always recreate those same successes.[317]

A social technology—a network to share and disseminate information and expertise—was necessary to bring together knowledge that people needed to find solutions for individual problems through the use of computer technology. In order to create ties between organizations and the sharing of resources and solutions, other local groups like the DCCG would need to be discovered and brought together; someone would then need to provide funding for such an umbrella organization. In the late 1980s, Apple Computer offered the necessary resources to bring this idea to reality.

During the winter of 1986/1987, Jackie Brand reduced her hours as the Executive Director of the DCCG to half time, in order to devote more of her time to working with Alan Brightman at Apple toward the creation of a national disability and computer technology organization.[318] Brand and Brightman's project would become the National Special Education Alliance. Brightman described their goals for the project, shortly after its creation:

> Many wonderful organizations that support disabled users have been working separately on many of the same challenges and issues. We established the NSEA to link these groups together for mutual benefit; to help individuals discover working partners; to ensure the timely sharing of information; and, ultimately, to serve the computer-related needs of disabled children and adults within their communities by

---

317 Jacquelyn Brand, "Parent Advocate for Independent Living," 57-58.

318 Dissertation. Robert Dodds Glass. "Partners in the Promise of Technology: An Historical Analysis and Impact Description of the Alliance for Technology Access," PhD Dissertation, School of Education, University of Louisville, KY, April 1992, box 1, folder 2, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 54. Glass wrote his dissertation while working for the Alliance. He had served on the Alliance Planning Team of the NSEA since Fall, 1987. When the organization changed its name to the Alliance for Technology Access, he was also a board member and the assistant to the executive director. His research included materials from the ATA and interviews he conducted with various members.

> providing them with information and resources that they may not otherwise have access to.[319]

The exchange of knowledge and expertise across the country, while serving the local needs of people with disabilities, was the core value behind the Alliance. It was intended to remedy the observation its founders made that information on computer solutions for people with disabilities was difficult to come by, and that difficulty was an obstacle preventing more people from accessing technology that could benefit them.[320] People involved with the NSEA believed in the importance of the need to spread information about new accessible computer technologies for three reasons:

> First, the development of new technology solutions is occurring so rapidly that parents and professionals alike find it increasingly difficult to keep up with the new possibilities...
>
> Second, these efforts can help schools and parents to invest scarce resources more wisely—for example, by avoiding the purchase of outmoded technology, inappropriate software, or a device of which a competitor has just produced a cheaper and/or better version....
>
> Finally, widening local public awareness of what is now possible technologically helps speed up the process of service delivery....
>
> In other words, public information leads to public action.[321]

The acceleration of personal computer development made it difficult to keep up with the latest technologies, especially for people and groups who lacked extra resources to devote to keeping on the cutting edge of innovations. At the same time, consumers were becoming increasingly aware of the potential for personal computer technology to benefit their lives—creating a market for new accessible technologies. What was needed was a bridge—between developers and consumers—to provide expertise and advice, while communicating the needs and desires of users back to developers.

---

319 Quoted in Harvey Pressman, "National Special Education Alliance," *The Exceptional Parent* 17, no. 7 (1987): 12-18, 21-22.

320 Pressman. "The National Special Education Alliance: Applying Microcomputer Technology," 2.

321 Ibid., 22.

Utilizing the same strategy behind the DCCG, but on a national scale, the NSEA founders believed that the best way to solve the problem of the transfer of knowledge was via partnerships between consumers, disability professionals, and the computer industry.

> The key idea is the notion of collaboration between parents and professionals... The power of this idea, especially as it relates to populations with special needs, can hardly be overemphasized. Donna Dutton, director of the Computer Access Center[322] in Santa Monica, believes that if these groups work together, they can get "ten times as much accomplished" as either could achieve separately. She also points out that parents and professionals do not easily divide between "us" and "them" on the basis of technology sophistication. Some parents are considerably more sophisticated than professionals on that score, and vice versa.[323]

The acknowledgment that anyone could become an expert in computer technology—parents, teachers, even children—kept the NSEA from being modeled on a one-way street, of professionals sharing their knowledge with consumers, without a way for the latter to speak back. Such an environment, where professionals and consumers were not on equal footing, was argued by the NSEA to already be causing problems in the introduction of computer technology to special education:

> As many special education experts have pointed out, one main impediment to the delivery of educational services to students with disabilities is the way in which parents and professionals relate—poor communication, no communication, feelings by the parents that they are being talked down to or ignored, feelings by professionals that they are being inappropriately challenged or criticized by parents, and so on.[324]

The NSEA founders believed that a partnership, where both technology users and technology vendors played roles, would solve some of these communication problems. Brand, in particular, felt that a national Alliance, composed of partnerships between consumers and companies, could work to help individuals locally: "NSEA demonstrates

---

[322] The Computer Access Center was one of the NSEA charter member organizations.
[323] Ibid., 21.
[324] Ibid.

how a community/industry partnership implemented on a national level can have dramatic impact on the most local level—changing the world one person at a time."[325] This was the NSEA's ultimate goal—to coordinate organizations across the country as a way to improve the lives of individuals; through a partnership, both users and developers would have a place to speak to each other, with the NSEA facilitating the conversation in the middle.

In order for Brand and Brightman's vision of an industry/consumer partnership that could change the lives of individuals with disabilities for the better to become a reality, Apple Computer had to donate time and money to the creation of the NSEA. The NSEA was founded at a time when Apple had both the interest in and resources to commit to creating such an organization. Jackie Brand described Apple as having a "real commitment to the issues—and not seeing the alliance as some kind of marketing strategy."[326] Apple's dedication to people with disabilities was in line with its stated corporate value of focusing on individuals and improving lives through computer technology. These values were embedded in the company from its founding. An employee task force memo from September 1981 codified the values the company held as goals. Among these stated values were:

- We build products we believe in.
- We are here to make a positive difference in society, as well as make a profit.
- Each person is important; each has the opportunity and the obligation to make a difference.[327]

---

325 Annual report. Jacquelyn Brand, "From the National Special Education Alliance," *The DCCG Report: Rose Street Edition July, 1987 - June, 1989,* page 8, box 1, folder 2, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 8.

326 Quoted in Divoky, "Apple Sponsors a New Alliance," 46.

327 Quoted in Owen W. Linzmayer, *Apple Confidential 2.0: The Definitive History of the World's Most Colorful Company* (San Francisco: No Starch Press, 2004), 82.

Apple was founded on values that technology can change the world for the better and should be shared; these values were reflected in the philanthropic work that the company did. As it grew into one of the major personal computer manufacturers, however, Apple's founding countercultural and hobbyist computing values struggled against its concern with the bottom line, a conflict that played out in the area of accessibility.

These clashing corporate goals of maximizing profit versus a utopian ideal of doing the right thing can be traced back to Apple's founders; the different personalities of Steve Jobs and Stephen Wozniak were reflected in Apple's corporate culture, technological developments, and tensions within the company. This can be seen in the very design of Apple's computers and its relationship with accessibility. Both Jobs and Wozniak valued elegance and minimalism in computer design, but in different ways. For Jobs, this was a matter of aesthetics and creating user-friendliness by limiting choices for users. For Wozniak, it was about efficiency in using resources so that users would have the option to do whatever they could imagine with the computer. Apple's computers were easy to learn and use, but the explicit black-boxing reduced flexibility for unintended uses. One of Wozniak's original visions for personal computers was that they would be flexible: “I had the idea that there would be a lot of things people would want in the future, and no way did we want to limit people.”[328] This goal of openness was enacted in the Apple II, but the company moved away from it with increasingly black-boxed designs starting with the Macintosh, as I discussed in chapter 3. Black-boxing their computers in the name of user-friendliness was one side of the same coin of paternalism which

[328] Stephen Wozniak and Gina Smith, *iWoz: Computer Geek to Cult Icon: How I invented the personal computer, co-founded Apple, and had fun doing it* (New York: W.W. Norton & Co, 2006), 133, epub e-book.

described Apple's early dedication to accessibility; one method restricted users' options while the other encouraged individual creativity, but both involved the company attempting to constrain what users could do.

There was inherent tension between these different versions of Apple's core values that led to clashes in both the technology developed and between the personalities of employees. For example, one of Jef Raskin's—the initial head of the Macintosh project—primary goals for the Macintosh was that it would be affordable, while also being user-friendly and functional.[329] Once Raskin was off the project, John Sculley set the price of the Macintosh much higher than competitor's computers, in order to gain short-term profits at the eventual cost of a greater market share.[330] Such clashes would lead uncompromisingly idealistic employees, such as Raskin, to eventually leave the company out of frustration with decisions made above them.[331]

Though the company was unable to always keep their more utopian values as their primary focus, there were occasional moments of resurgence when Apple lived up to its core values. For example, as I discussed in chapter 3, Raskin's intention for the Macintosh to empower people and John Sculley's instruction to Alan Brightman that if he was going to fail with the Office of Special Education, then he should fail big both embody Apple's founding values—that the potential of computer technology can change people's lives for the better. These values again surfaced with Apple's support for the NSEA. During testimony before Congress a few years later over the passage of the Technology-Related Assistance for Individuals with Disabilities Act, Apple described its

329 Levy, *Insanely Great,* 122.
330 Ibid., 180, 224-225.
331 Ibid., 121. The clashes for Raskin were both ideological and personal, between him and Steve Jobs.

support for people with disabilities as: "The corporate commitment by Apple Computer, Inc. toward the advancement of technology for use by individuals with disabilities is powerful, enduring and passionate."[332] Apple was one of the first major computer companies to have an internal group dedicated to people with disabilities and accessibility, in the form of its Office of Special Education and Rehabilitation which would take the more general name of Worldwide Disability Solutions in the late 1980s. Supporting people with disabilities fell in line with Apple's spoken mission of making computers for individuals; by taking into account as many uses of the technology as possible, the needs of as many individual users could be accommodated. Even with this focus on individuals, however, people with disabilities were still treated differently from other users in one key way: they were still not seen as a potential consumer market that money could be made off of. Computer users with disabilities were targeted out of a notion of doing the right thing, not as potential customers. Apple's paternalistic philanthropy toward people with disabilities allowed the company to live up to its founding values in a bounded way, controlled and circumscribed by its view of its users.

Apple's dedication to users with disabilities, even if the company did not quite see them as customers, did have a solid, long-lasting foundation within the company, though it would peter out in the late 1990s. Apple continued to supply resources to the resource centers even after the initial creation of the NSEA, as advertised in a promotional brochure from 1988: "To these charter-member centers—and to all new resource centers that join the Alliance—Apple offers ongoing assistance in the form of computer

[332] *Technology-Related Assistance for Individuals with Disabilities Act of 1988: Hearings on H.R. 4904, Before the Subcommittee on Select Education of the Comm. on Education and Labor*, 100th Cong (1988) (statement of James Johnson, Director of Government Affairs, Apple Computer, Inc.), 54.

equipment, resource materials, technical assistance, and moral support."[333] Apple would continue to provide such assistance and resources to the NSEA for another few years. The NSEA's time as a project of Apple was while John Sculley was CEO of the company. During the decade Sculley ran Apple, it experienced mostly success and stability, allowing the company to dedicate resources to its philanthropic concerns such as aiding people with disabilities.

4.1.1 NSEA Charter Members

The goals of the NSEA could only begin to become reality once likeminded organizations were located to combine together under the umbrella of the Alliance. I explain how these groups were selected and what resources Apple brought to the growing Alliance to connect these groups together. In creating the NSEA, Apple constructed a network of technology and disability advocacy that could function as a bridge to consumers with disabilities. While Brand and Brightman were working out the big picture of what the NSEA would be, Brand also began to travel around the U.S. with an Apple Office of Special Education and Rehabilitation employee, Robin Coles, to find other local organizations similar to the Disabled Children's Computer Group which had heard of the developing NSEA project and were interested in joining the Alliance.[334] "So along with Robin Cole, who was at Apple at the time, I traveled for about six months and we met groups and families and people who were getting things started, who wanted to get things started, who were looking for hope, who were excited about the possibilities,

[333] Brochure. "What do you do when the world tells you, 'That's all you can do?'" Apple NSEA brochure.1988, box 2, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley.

[334] Glass, "Partners in the Promise of Technology," 54.

and through that whole process of beginning to connect up a national community, started to really build the national organization."[335] Brand and Coles represented the kind of partnership, between consumers/activists and developers/companies, that the NSEA sought to create—a partnership which they then used to locate and gather together other organizations with the same goals and values.

The NSEA would enforce the ideals behind their partnership with those local groups chosen to join the Alliance. The NSEA had a number of criteria for these future member centers: "Acceptance in the Alliance requires that each resource center be a genuinely collaborative venture among people with disabilities, their parents and friends, and professionals in the fields that serve them (education, rehabilitation, and so on). Each resource center is led as much by parents of disabled individuals and the individuals themselves as by professionals."[336] In addition to the requirement of partnership, the local centers also had to be able to operate successfully within their local communities. "Their proposals for charter membership in the Alliance were accepted only after a series of on-site visits convinced representatives of Apple and DCCG that they were (1) capable of providing technology leadership in their areas, (2) more broadly based than an exclusively professional agency, (3) committed to the goals of the Alliance, (4) able to generate local support, and (5) enthusiastic about the potential of microcomputers to change the lives of people with disabilities."[337] The centers need to be viable, able to accomplish necessary goals, and operate in line with NSEA ideals.

As a benchmark of what the NSEA was looking for in a local disability and

---

[335] Jackie Brand, "Assistive Technology Oral History Project," interview with Chauncy Rucker, November 1, 2007, http://atoralhistory.uconn.edu/podcasts/brand.php.

[336] Pressman, "The National Special Education Alliance: Applying Microcomputer Technology," 1.

[337] Ibid., 3.

technology resource center, Apple used the DCCG as its model organization: “Apple defined its role as a catalytic agent, working with DCCG to try to identify places around the country where seeds of a DCCG-like operation might be planted.”[338] Ten resource centers across the country were chosen by Apple to join the DCCG in the Alliance. These centers were located in ten different states: California (DCCG and Computer Access Center), Colorado (Children's Hospital Resource Center), Florida (Computer CITE), Illinois (Technical Aids and Assistance for the Disabled Center), Kansas (Technology Resources for Special People), Kentucky (Disabled Citizens Computer Center), Massachusetts (Massachusetts Special Technology Access Center), Minnesota (PACER Center, Inc.), Nevada (Nevada Computer and Technology Center for the Disabled), and Ohio (Communication Assistance Resource Service).[339]

From the corporate end of the NSEA partnership, Apple continued its philanthropic dedication to people with disabilities through donations of various types to the charter member organizations. The company gave some computer equipment, made up of Apple IIs and Macintoshes, to each center. Apple also set up and maintained computer-based telecommunications between the organizations using AppleLink and paid for organization members to travel to national conferences for in-person meetings. To send the kind of message to communities that Apple wanted with the NSEA, the company also provided each charter center with a coffee urn, as a way, as Brightman described it, “to get the centers' directors thinking about how they can more effectively reach out into the community and bring teachers and parents into the centers.”[340] In a

[338] Ibid., 2.
[339] Ibid., 36.
[340] Quoted in Divoky, "Apple Sponsors a New Alliance," 46-49

more recent interview, Brightman recalled donating the coffee urns because they were "the equipment that said to people this is a place for people."[341] The environment at the local centers was intended to be one of community and involvement—echoing the value of partnership at the core of the Alliance. This type of humanizing gesture acted to normalize the computer technology environment of the resource centers by providing something as everyday as coffee for visitors—much as the name "Apple" helped to make Apple Computer seem friendly and non-threatening as a computer company: one step into making the complex technology of the computer into everyday technology.

Apple's goal in providing these resources to the centers was to connect them together so that they could share knowledge and experience with each other. This was the network of technological and disability expertise that the NSEA believed could best disseminate information between consumers and developers. There were four components to the NSEA's strategy for communication and networking between the centers; the first two dealt with computer networks:

> First, the centers have been electronically linked to one another via AppleLink, Apple's information and communications network.
> Second, each center has been linked to major national databases and bulletin boards via both AppleLink and SpecialNet, the largest telecommunications service in the country devoted specifically to special education and rehabilitation.

Providing the centers with both AppleLink and access to SpecialNet took advantage of early personal computer networking capabilities to connect the centers to both each other and the outside world. AppleLink provided email and instant messaging capabilities between computers located at the different NSEA centers.

AppleLink had debuted only a few years earlier, in 1985, as the first online

[341] Brightman, "Assistive Technical Oral History Project."

service with user-friendly windows and icons instead of a command-line interface.[342] It was run as a joint project between Apple and GE, intended for employee use only and was not available to the general public. A Personal Edition of AppleLink for the public was offered in 1988 and would, through a partnership with a company called Quantum, go on to become America Online.[343] In a later interview, Brand told a story demonstrating the kind of impact AppleLink had on what the centers could accomplish through distributed communication:

> We would get emails like, “A family just came in and the kid is trying to do math and he's really interested in race cars, and he's not able to really handle the computer, and help! What ideas do you have?”And within twenty-four hours from all over the country, people would throw out everything they knew, everything they had come across from, gosh, “There's somebody in a small town in Kansas who's just developed this great little car-racing program that has math built into it,” to, you know, “I just met with somebody and here's a way I used a new keyboard—it was very successful.”[344]

This kind of exchange of information through networked computers also took place on a larger scale with the centers' access to SpecialNet. SpecialNet offered around one hundred different electronic bulletin boards that people all over the country could connect with via a modem. It brought together special education offices in every state, two thousand school districts, hundreds of colleges, and various other programs.[345] The use of this early networking technology showed disability activists at the cutting edge of computer technology, embracing it as it developed to find the best technological solutions for people with disabilities. Networking technologies, in particular, demonstrated the new kinds of abilities that personal computer technology made possible, such as

[342] Linzmayer, *Apple Confidential 2.0,* 147.
[343] Ibid., 148.
[344] Brand, “ Parent Advocate for Independent Living,” 64.
[345] Jane Ferrell, "Computers help the disabled get an equal chance," *San Francisco Examiner,* Sun, March 24, 1985, D3.

communication over the SpecialNet bulletin boards.

In addition to implementing electronic networking capacities for the centers, Apple also set up ways for NSEA members to interact directly with vendors and to meet together in person:

> Third, Apple has created a category of membership in the Alliance called "charter member organizations" - professional organizations, technology vendors, publishers, research and development centers, rehabilitation centers, and the like. These organizations have agreed to keep the resource centers informed about new and forthcoming products and ideas, and to cooperate with individual centers in identifying appropriate solutions, training local people in the use of technology devices, and making experimental materials and ideas available to the centers for field testing.
> Finally, recognizing the importance of initial face-to-face contacts among individuals working in the centers, Apple has initiated a series of national meetings designed both to provide training and orientation to the members, and to give them the all-important opportunity to get to know each other as well as many of the participating vendors and professional organizations.[346]

Face-to-face meetings mainly took place at conferences related to disabilities and technology, giving resource center representatives opportunities to meet with each other and to connect with others working on related projects external to the NSEA. Brand described the role and importance this electronic and face-to-face communication network played in what the NSEA was capable of accomplishing.

> We basically gathered information that was otherwise unavailable. It wasn't documented anywhere. It was direct experience and feedback and sharing of resources that all of a sudden gave us a sense that there was now a national focus on issues we had been struggling with, one by one, in our own little programs, in our own homes, in our own little centers. And so it was a very empowering process, and a very exciting one, the early creation of the Alliance.[347]

These different aspects of the communication network Apple established for the NSEA—both electronic-based and consisting of face-to-face communication with other centers

---

[346] Pressman. "The National Special Education Alliance: Applying Microcomputer Technology," 32-33.
[347] Brand, " Parent Advocate for Independent Living," 64.

and technology vendors—allowed the NSEA to create a larger resource of information than any individual center could achieve.

Spread across the country, this shared pool of expertise made the NSEA as a whole more than just a collection of local centers. A distributed information network allowed the NSEA centers to stay small and locally focused while finding solutions to problems beyond their limited expertise by connecting with others. With its access to the AppleLink service, the structure of the NSEA functioned as a computer network, with each center able to contact online the computers at the other centers. This was before there was large-scale public access to the internet and allowed the NSEA centers to operate with each other in a way that computer networking technologies would, in a few years, allow everyone to access information at a distance. This computer network also allowed direct communication with other people through their computers. Murray Turoff's late 1970's vision of future communication through computer conferencing, which I discussed in chapter 2, began to be enacted here. Though the form AppleLink took permitted a far more user-friendly system than the technology Turoff envisioned. As Turoff had hoped, however, computer networking technology was being used to benefit the lives of people with disabilities. The development of these cutting edge technologies collided with disability issues as personal computers granted new kinds of abilities to users. People with disabilities were the paradigmatic computer users, embodying the need for the new capabilities the technology could provide and demonstrating how the personal computer could augment all human abilities. Accessible computer technologies were the first step in developing machines which were usable for everyone, progressing to the fulfillment of the computer as the universal tool.

4.1.2 Benefits for Resource Centers and Technology Vendors

In the Spring of 1987, the NSEA project officially launched, with eleven local resource centers and fifty-three third-party vendors of computer technology and professional organizations;[348] both resource centers and vendors saw immediate benefits from being a part of the Alliance, demonstrating its success for both the consumers and professionals who had joined the NSEA partnership. These benefits enticed local centers and technology vendors to join the Alliance and kept them working toward the organization's success. From the perspective of the local centers, being connected directly with Apple had advantages beyond the material donations the company made. The resource centers found that Apple's name on the project accrued them greater attention from other organizations. Carol Cohen, of Computer CITE in Florida, described the increased generosity her local community showed after CITE joined the NSEA: "If you mention that you have support from Apple, people want to help you. Apple is like a magic word."[349] The association with Apple that the NSEA provided worked to open doors for small, local groups who otherwise might have no direct ties to a prominent technology company. The centers did not only have Apple to rely on, however, but also had access to each other from the communication system Apple had set up. The NSEA found the diversity of the various centers to be a positive aspect of the Alliance, as it allowed technical expertise to be distributed across the various organizations.

---

348 Glass, " Partners in the Promise of Technology," 55.

349 Quoted in Pressman. "The National Special Education Alliance: Applying Microcomputer Technology," 15.

> One of the strengths of the Alliance as a whole is the difference in the initial strengths of the members, since this enabled members to get help from one another. For example, one center has special expertise and long experience in developing technology solutions for people with visual impairments, another is especially knowledgeable about communication aids and devices, and a third has worked intensively to develop technology solutions for young children with severe disabilities.[350]

Once the NSEA was established, the centers could immediately pool and rely on the expertise of each other to solve problems and aid the disabled population more effectively than they could when they were isolated.

As much as Apple was responsible for creating the NSEA and donating essential resources to each local center, even from the beginning, the NSEA was not an Apple-exclusive organization. It was deeply connected to Apple, but was not a direct branch of the company. In numerous NSEA promotional materials and published articles, Apple proclaimed the hands-off approach they took with the centers and the lack of any requirements that Apple products be promoted or used:

> The equipment needed by an individual is the equipment that needs to be used, whether it's Apple, Atari, or whatever. The resource centers are not Apple centers; and they are not run by Apple Computer.[351]

Apple's public promise that "the Alliance, then, is not a division of Apple"[352] was enforced in the way decision-making was structured within the NSEA. The Alliance Planning Team—the initial planning group of the NSEA for its first few years—was required to always have representatives from parents, consumers, professionals, and vendors. Brightman further decided that Apple would only have one voting member in the group.[353] This distancing of Apple from overt control of the NSEA was a

350 Ibid., 12.
351 Quoted in Pressman, "National Special Education Alliance," 17.
352 "What do you do when the world tells you, 'That's all you can do?'"
353 Glass, "Partners in the Promise of Technology," 57.

manifestation of the company's philanthropic, though paternalistic, attitude toward both the Alliance and people with disabilities. Apple did not attempt to use the NSEA as a way to attract people with disabilities as a profitable consumer market, but instead seems to have viewed the disabled population, in this context, only as a group who could benefit from Apple's goodwill.

For both Apple and the third-party vendors who joined the Alliance, the NSEA brought them benefits as well. Apple and the other companies found their reputation improved among both people with disabilities and disability professionals. Though Apple did not explicitly look toward people with disabilities as a market, the NSEA did help organize people with disabilities as consumers that computer technology companies would eventually try to appeal to, by generating increased use of computer technology among people with disabilities.[354] The NSEA did not only disseminate information to potential users, but also communicated back to developers. The idea of a partnership at the heart of the NSEA also created an opportunity for technology companies to gain direct feedback from consumers about their needs:

> ...these grassroots organizations, now connected in a meaningful way, suddenly have a greater potential value to the vendors than they had as individual organizations. They offer a source of unified consumer feedback, provide ideas for new products and programs, act as "showcase sites" for products, and (increasingly as the Alliance grows) provide a means to reduce the lag time between the arrival of a new product on the market and awareness of its existence among special-needs purchasers.[355]

The exchange of knowledge between members of the Alliance also impacted technology development, as vendors had a new way to communicate with users of their products. Small, third-party vendors not only found it easier to communicate with consumers

[354] Pressman, "National Special Education Alliance," 18, 21.
[355] Pressman, “The National Special Education Alliance: Applying Microcomputer Technology,” 35.

through the resource centers as a part of the NSEA; they also discovered that they had access to greater attention from Apple:

> As Dr. Mary Wilson, president of Laureate Systems, describes it, the connection of the centers with Apple Computer encourages vendors to be cooperative. "The centers have much higher visibility because of the Apple connection," she reports. "They also give us a way to indicate to Apple that we want to work with them. As a relatively small vendor, we might otherwise not get as much attention from Apple technicians and programmers."[356]

One of the motivations behind the NSEA had been not only greater transfer of information to technology users, but also the quicker development of products. The communication system established by the NSEA placed the Alliance in a position as a go-between for users and developers, but it was a position composed of members of both groups, where both could interact with each other as an attempt to equalize the power between each group.

4.2 The Alliance Becomes Independent

The NSEA did not remain a part of Apple Computer for long; once the Alliance was up and running, its leaders quickly looked to its independence from Apple. The NSEA's reasons for splitting from Apple were two-fold: being entangled with Apple created inherent limitations for what the NSEA could become while also making the NSEA dependent on Apple's largesse. The Alliance's work providing knowledge and hands-on experience of personal computer technology for people with disabilities and feedback for developers would change from being one small project within a mass-market computer company to its own self-sufficient organization, but with a significant

[356] Ibid.

history in its links with the computer industry. During the two years after it was formed, the NSEA engaged in the process of separating itself from Apple Computer to become an independent, non-profit organization. In the Spring of 1988, Jackie Brand formally left her position as Executive Director of the DCCG to work full-time at Apple Computer, as Executive Director of the NSEA project.[357] That Fall, NSEA employees began to meet with Apple's lawyers to look into legally separating the Alliance from Apple.[358] Though Apple showed no signs yet of wanting to stop supporting the NSEA, the company was willing to let the project go with no struggle. As a part of the changing relationship between Apple and the NSEA, the Alliance Planning Team instructed NSEA centers to prevent possible conflicts of interest by ending the sale of Apple computers directly through the centers.[359] On February 28, 1989, the NSEA became its own corporation, operating under the NSEA Foundation, and filed for nonprofit tax status. Brand described the status of the relationship between the NSEA and Apple in the application for the group's nonprofit status:

> Apple's experience with this project has led it to conclude that a national foundation, which is not controlled by Apple, may benefit people with disabilities by making it more likely that corporations other than Apple will support it. Therefore, Apple has encouraged the formation of the NSEA Foundation as an independent entity. Apple will provide start-up support to the Foundation. However, Apple will reduce its role as the Foundation develops more broadly-based support.[360]

Though Apple's oversight of the NSEA was diminishing, Brand was able to use funding from Apple to hire the first three staff members of the NSEA: Donna Dutton—head of

---

357 Glass, " Partners in the Promise of Technology," 59.
358 Ibid., 61.
359 Ibid., 65.
360 IRS form. Jacquelyn Brand, Form 1023 - Application for Recognition of Exemption Under Section 501(c)(3) of the Internal Revenue Code, 4/4/89*,* box 1, folder 3, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley.

the NSEA member Computer Access Center in Santa Monica, California, Harvey Pressman—author of most NSEA publications, and Robert Glass—co-founder of the Disabled Citizens Computer Center in Louisville, Kentucky.[361]

The NSEA needed to separate itself from Apple: in order to best connect users with computer technology that could benefit them; the organization needed to be free of corporate ties that might limit what it would be allowed to do. The Alliance could not effectively function as a bridge between users and developers if it fell under the auspices of one of the major computer companies. By the Fall of 1989, the NSEA was a completely independent non-profit organization and the Apple Computer logo was removed from its materials. All NSEA resource centers were required to also have non-profit status. In order to more accurately reflect the goals of the NSEA as being concerned with more than just special education, the organization changed its name to the Alliance for Technology Access (ATA).[362] The ATA also set up a new national office in Albany, California, in order to further establish its independence from both Apple and the DCCG, from both of whom it had previously borrowed space.

Jackie Brand viewed the ATA's separation from Apple as an inevitability if the Alliance was going to become the kind of organization it wanted to be. In a later interview, Brand discussed her perspective on this necessity:

> Our missions were distinct: the bottom line for Apple was to make money, the bottom line for the Alliance for Technology Access was to provide technology and information about technology to people with disabilities. I always worried about the day when it would become not so interesting to Apple anymore, and we were always trying to prepare for that eventuality.[363]

---

[361] Glass, “Partners in the Promise of Technology,” 67.
[362] Ibid., 71-72.
[363] Brand, " Parent Advocate for Independent Living,” 67.

Brand was concerned that their discrete goals would eventually cause Apple to stop supporting the ATA; the Alliance would be unable to best pursue its mission if it stayed dependent on the company. In the late 1980s, people with disabilities were still a philanthropic concern for Apple, rather than a strong market segment; Apple's generosity could not continue indefinitely at such a cost and the company's interest in supporting the Alliance would not last. Starting in the late 1980s, Apple cut back on the resources they donated to the ATA and its member centers. Glass described the dwindling support from Apple: "From this time onward, poor computer sales industry wide and repeated challenges internally from higher management authorities at Apple Computer over the value and wisdom of investing dwindling marketing budgets in the field of disability cause Apple's corporate contribution to the Alliance to begin diminishing."[364] Not seeing people with disabilities as a viable consumer market, Apple's philanthropic attention decreased when other concerns took priority. As a consequence of this divestment, in early 1990, OSER cut its support of AppleLink between the Alliance centers, as it lacked the budget to continue funding the project; the ATA took over funding the AppleLink connection itself.[365]

As the ATA grew and began to support itself through contributions beyond just Apple, it turned to larger projects, moving beyond just local work and connecting discrete groups to national concerns. The network the ATA had constructed was capable of expanding to include different ways of reaching computer users with disabilities, beyond direct one-on-one contact between a client and a member center. At the top level of the

---

[364] Glass, "Partners in the Promise of Technology," 68-69.
[365] Ibid., 72-73.

organization, work done by the ATA involved more than just maintaining a communication network between resource centers; the Alliance's dedication to using computer technology to break down barriers for people with disabilities extended to projects involving education, training, funding, and technical support for the centers and their clients. In the Alliance's application for non-profit status, Brand listed many of the types of programs the organization intended to pursue:

> * Educating and training people with disabilities, their families, and service providers in the use of computer-related technology to remedy specific problems caused by various disabling conditions;
> * Developing educational materials so that other exempt organizations can offer similar programs;
> * Funding the training of service providers, people with disabilities, and family members in the use of computer-related technology;
> * Making grants to exempt organizations to develop service for people with disabilities;
> * Making grants to individuals for further study and training in the use of computer-related technology by people with disabilities;
> * Developing, or funding the development of, technological solutions to problems encountered by people with disabilities; and
> * Providing technical assistance to other exempt organizations in such areas as outreach to minority people with disabilities, preschool and K-12 programs, organizational development, and program development.[366]

The ATA would carry out many of these activities as it grew over the following few years. Within two years of its founding, the ATA had grown to include 38 local technology resource centers in 28 states; by 1992, there were 45 centers in 34 states.[367] The Alliance would stabilize around this last number; since the early 1990s, the ATA has included between 40 and 45 centers under its network umbrella. This appears to be the limitation of what the ATA network is capable of; the Alliance has been unable to grow much larger

---

366 Brand, Form 1023.
367 Brand, "From the National Special Education Alliance," 8 and Glass, "Partners in the Promise of Technology," 136.

than it was the few years after its start or to include local centers in every state in its network. With hindsight, this limitation appears to be based in the ATA's network structure, composed of many small, local organizations. These organizations were frequently reliant on the energy and dedication of the individuals running them; they were susceptible to failure when these individuals lost the energy and interest in maintaining these groups. However, while having occasional problems with centers failing and dropping out,[368] the ATA has managed, as a whole, to stay stable and maintain its mission since its founding.

4.3 The DCCG after the Brands, 1987-1991

While the ATA was growing into a national presence in disabilities and technology, the DCCG continued to provide services for individuals with disabilities at a local level. The DCCG acts as a counterpoint to the ATA—a social technology network of disability advocacy and computer technology at a different scale of operations. Where the ATA worked on large projects, connecting groups across the country together, the DCCG continued to function locally. It was the place where users came in and allows for an examination of the immediacy of interactions between computer users with disabilities and accessible computer technologies. Unlike other small, local organizations that crumble when their founders move on, the DCCG remained strong after the Brands left and continued their work bringing together people with disabilities and personal computer technology at a local level. The DCCG continued as a successful local organization, enacting the ideals of the ATA. Kate Sefton and Linda De Lucchi took over

[368] I return to this issue during the early 1990s in chapter 5.

for Jackie and Steve Brand, in 1988, as the Executive Director and President of the DCCG, respectively.[369] De Lucchi was a former employee of the Lawrence Hall of Science, where the DCCG was founded, and one of the DCCG's first members. Sefton was a professional developmental therapist who had immediate family members with disabilities and had seen first-hand how computer technology was able to impact their lives for the better.[370] Sefton stayed as Executive Director until the end of 1989 and was then replaced by Lisa Wahl.[371] Sefton's perspective on disseminating knowledge of computer technology to users emphasized the necessity of keeping pace with changes to the technology: “Being on the leading edge of a movement requires knowledge and understanding of the exciting developments on that edge.”[372] In order to stay on this cutting edge, the DCCG needed space where people could interact directly with the technology.

In 1988, the DCCG moved its Resource Center into a much larger space on Rose Street, in Berkeley, where it would remain until 1992. This increase in space allowed the DCCG to have dedicated room for administrative uses, computer and other technology storage, and large events. By 1989, programs at the DCCG were divided into five categories: the Interactive Computer Resource Center, Technical Problem Solving, Training, Loan Programs, and Communications.[373] These different kinds of activities

---

[369] Both Jackie and Steve Brand left their governing positions at the DCCG in 1988, though both remained on its Board of Directors for a few more years.

[370] Annual report. Kate Sefton, “From the Director,” *The DCCG Report: Rose Street Edition July, 1987-June, 1989*, box 1, folder 2, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 3.

[371] Glass, “ Partners in the Promise of Technology,” 72-73.

[372] Sefton, “From the Director,” 3.

[373] Annual Report. Disabled Children’s Computer Group. “DCCG Programs and Services.” *The DCCG Report: Rose Street Edition July, 1987-June, 1989*, box 1, folder 2, Coll. BANC MSS 99/185,c Bancroft Library, University of California Berkeley, 4-5.

demonstrate the different strategies the DCCG attempted to bring people with disabilities together with personal computer technology; in the same way that accessible technologies needed to meet the needs of different individuals, the DCCG targeted its communication with users based upon what they most needed or wanted out of the technology.

The Interactive Computer Resource Center involved the various meetings and workshops that were regularly held for large groups of people to come in and learn about what the DCCG offered and what technology was available, including open houses, workshops, and outreach to underserved populations in the area. For example, in December 1991, the DCCG held a workshop on Toy Adapting and Switch Making.

Technical Problem Solving programs were more focused on one-on-one or small group interactions and were aimed at families, professionals, vendors, and Special Interest Groups within the DCCG for either people with specific kinds of disabilities or users of certain technologies. Such groups, which appear to have met monthly, included a Visually Impaired Interest Group, an Interest Group on Technology for Persons with Severe Disabilities, a Unicorn Users Group, a Dialog with Developers group, and a HyperCard Interest Group. By 1991, an Augmentative Communication User Group and a Computer Maniacs group had also been formed. The former, in particular, held frequent meetings (up to two or three times a month) and had separate subgroups for both adults and children. These groups were not only DCCG staff or interested users; both Arjan Khalsa from Unicorn Engineering and Mike Palin from Words Plus came in to the DCCG in 1989 to work with the relevant Special Interest Groups.[374] These groups were one place

[374] DCCG event calendars. I am assuming these six months worth of calendars are representative for the

where users and developers could come together, with the DCCG acting as a channel for communication. Users groups also put an emphasis on tinkering, with users solving problems for themselves and sharing those solutions with each other.

Training activities connected the DCCG with school district staff who needed help with technology, the Kids on Keyboards program for children that attempted to improve the local community's technical expertise as a whole, and conference presentations. Kids on Keyboards, started in 1988, was a popular and oft-mentioned DCCG program, which De Lucchi described as: “Youngsters meet in an informal atmosphere, learning computer skills while making friends and sharing a joke. Kids on Keyboards is only possible because of the dozens of volunteers that work, learn, and laugh right along with the children.”[375] The DCCG also had plans for future Training programs that would deal with small seminars and video production. Small seminars on topics such as Unicorn keyboards, Macintosh computers, and Beginning Technology were beginning to be held by late 1991.

The DCCG ran a number of Loan Programs for people to borrow items and technologies such as: software and adaptive devices to test before purchasing for themselves, and printed resources and videotapes for people to learn from on their own. This collection of loanable technologies allowed the DCCG to account for the different kinds of embodied use their clients experienced and provide a means for users to test various technologies to discover what fit them best. In 1987, Pacific Bell donated a larger space for the DCCG to move their Resource Center to; here, the organization was able to

DCCG's activities throughout the late 1980s and early 1990s.

375 Annual report. Linda De Lucchi, “From the President,” *The DCCG Report: Rose Street Edition July, 1987-June, 1989*, box 1, folder 2, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 2.

set up one of their most popular loan services, the Toy Lending Library. Run by Alice Wershing, a special education teacher and member of the DCCG's steering committee, the Library maintained a collection of toys and games, of both advanced computer technology and simple mechanical or traditional toys.[376] Wershing worked with children —from infants to nearly teenagers—and their families to test and play with the toys, as a way to figure out what toys the children most enjoyed and could be made to fit their individual disabilities.[377] In addition, a 1987 article on the DCCG mentions that the organization had modems they would loan out so that people could access a free electronic bulletin board run by the group.[378]

These various lending programs helped to fulfill one of Steve Brand's goals for the DCCG of finding better ways to connect people with technology that could benefit them. In 1987, an NSEA booklet described his perspective on the importance of being able to try out technology to find what works:

> One thing that's become important to [Steve Brand] is to increase and improve the lending of hardware and software to members. He wants to be able to say, "Here, take this home. Try it out. See if it works." He wants to find ways to make it easier for people who still think the computer is a "longshot" in helping their children, who don't yet realize all the ways it can brighten their futures, who feel it is "too hard" to understand all this new technology.[379]

By the late 1980s, the DCCG's expanded loan services were allowing ways for people to test out and play with cutting-edge accessible computer technology on their own time, as a means to familiarize themselves with what was out there and find solutions for their

---

376 Pressman, “ The National Special Education Alliance: Applying Microcomputer Technology,” 7.

377 News article. Sara Hirsch. “Toy Lending Library,” *Bay View*. The Junior League of Oakland-East Bay, Inc. v. 16 n. 5, Feb, 1988, pg. 10, box 1, folder 7, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 10.

378 Harvey Pressman, "Jackie Brand: DCCG," *The Exceptional Parent* 17, no. 7. (1987): 57.

379 Pressman, “ The National Special Education Alliance: Applying Microcomputer Technology,” 8.

individual embodied uses. This allowed for experimentation with technology in a way that was otherwise unavailable for consumers and allowed for finding what fit personal needs best.

Finally, DCCG Communications programs involved technical information and product referrals sent by phone calls and through the mail, as well as a regular newsletter. By the early 1990s, the DCCG had clearly expanded beyond their early focus to now incorporate wide interests of both children and adults with disabilities, as well as providing resources and training for people with all levels of computer expertise and different kinds of disabilities. They also stayed small and locally-focused, while at the same time were able to take advantage of the exchange of knowledge and expertise that being a member of the ATA provided. The DCCG provided face-to-face contact between users and computer technology, working directly with them to find technological solutions to their individual needs. Within the ATA, the DCCG—and other member centers like them—functioned as separate nodes, connected by the communication network the ATA created, linking each center with all the others, as well as between centers and technology vendors.

4.4 IBM Programs and Technologies for People with Disabilities, 1984-1991

Apple Computer, and its work with the ATA, was not the only large computer company dedicating resources to accessible computer technology during the late 1980s; IBM replicated some of the same philanthropic efforts as Apple in the form of its

National Support Center for People with Disabilities and developed its own accessible personal computer technologies for its employees and customers. To make it easier for people with disabilities to obtain technologies, IBM ran the Offering for Persons with Disabilities program through its National Support Center, during the late 1980s and early 1990s. This program operated through local disability service organizations to provide computer technologies (IBM Personal System/2 and related products) for people with disabilities at a discount.[380] The discounts offered were between 33 to 50% off and were intended to be used for purchases for rehabilitative purposes. The local service organizations—mostly branches of the Easter Seals or United Cerebral Palsy Association —helped individuals using the program select, order, and install IBM products.[381] Similar to Apple, IBM worked with these external disability advocacy groups to reach people with disabilities who the company believed would benefit from its products.

A 1988 bulletin in the ACM Special Interest Group on Computers and the Physically Handicapped newsletter described the necessary qualifications for individuals with disabilities to acquire computer equipment through the program.[382] Initially, the discounts were only available to residents of ten states, through the Easter Seals or United Cerebral Palsy, before the program expanded in 1989 to include other independent local organizations.[383] By 1990, there were thirty locations across the country where people could participate in the program. Interested people with disabilities were required to

---

380 IBM National Support Center for Persons with Disabilities. "Technology for Persons with Disabilities," preface.

381 Ibid., 11.

382 Carl Friedlander, ed. "Reduced Cost Microcomputers Available." *SIGCAPH Newsletter,* no. 39 (1988): 5-6.

383 "National Support Center; a Service of IBM." *The Exceptional Parent*, *8th Annual Computer Technology Directory,* Nov 1, 1990, 2.

supply certification of their disability from a physician. The physician also needed to show that the computer equipment being asked for would provide a "therapeutic or rehabilitative benefit" to the user.[384] In terms of the types of disabilities that would qualify someone for the program, IBM kept the requirements broad and inclusive, including people with a "visual, auditory, physical, neurological, learning, or developmental disability; with a communicative disorder, and/or with a similar disability or disorder."[385] Eligible users could purchase one computer system per year for personal use only. As described in the SIGCAPH newsletter, local Easter Seals Service Centers would determine applicants eligibility, consult on technical equipment for the intended user, recommend additional adaptive devices they may need, help place the order with IBM, and provide assistance in installing the computer system, as well as ongoing support.[386] A few years later, IBM would expand their efforts with external advocacy groups to work directly with the ATA, as I describe in the next chapter.

Beyond providing ways for people with disabilities to acquire personal computer technology that might benefit them, IBM also developed its own accessible technologies in-house. The creation of these technologies was different from the philanthropic efforts of Apple: while working from a desire to benefit people with disabilities, IBM began from pragmatic concerns to make computers accessible for its own employees, which grew into marketing technologies for the public. People with disabilities were still not perceived as a valuable market share by computer companies, but were, at this time, beginning to be considered more as consumers than as charity. IBM started developing

---

[384] Friedlander, "Reduced Cost Microcomputers Available," 5.
[385] Ibid.
[386] Ibid., 5-6.

products for their Independence Series in the late 1980s. Prior to this collection of software, there were two significant IBM technologies that made the IBM PC more accessible for people with disabilities. The first, the IBM Screen Reader—the product from which general screen reader technology evolved—was created by Jim Thatcher, a mathematician at IBM's Thomas J. Watson Research Center in New York. As with many of the accessible technology developers and activists I have examined, Thatcher became involved in computer accessibility for personal reasons: his thesis advisor and fellow IBM colleague, Jesse Wright, was blind and needed better access to the IBM computers he worked with. In 1984, the two of them began to work on an "audio access system" for the IBM PC, which could read aloud text displayed on the screen.[387] They named this product PC SAID, after the SAID (Synthetic Audio Interface Driver), a prototype IBM talking terminal developed in 1978, that gave blind users access to the IBM 3277 computer mainframe system.[388] Their work on PC SAID would become, two years later, the IBM Screen Reader for DOS. Thatcher did not set out to create a commercial product with the Screen Reader: "I had no idea it would become an IBM product because I was just having fun, making the PC accessible for Jesse."[389] As the first Screen Reader was created to make IBM computer accessible for its own employees, it was not a trademarked product. Screen Reader would evolve into the Screen Reader/2, the first screen reader for IBM's graphical user interface operating system, Operating System/2.

The second accessible technology created for IBM personal computers was AccessDOS, a free suite of keyboard accessibility features that ran on DOS and worked

---

[387] Cooke, "A History of Accessibility at IBM."
[388] Ibid. and Kafer, "A Fair Chance," 41.
[389] Quoted in Cooke, "A History of Accessibility at IBM."

with the IBM PC, PS/2, or compatible computers. AccessDOS was developed by the TRACE Center, at the University of Wisconsin-Madison, with funding from IBM and the National Institute on Disability and Rehabilitation Research, and was released in 1991.[390] The suite included many of the accessibility features that were also built into the Macintosh during the mid-1980s, the kinds of flexible user-experience tweaks that later became integrated into operating systems as standard options. AccessDOS was designed to allow alternate ways of using the keyboard, particularly for people who had trouble with hand coordination or who could only press one key at a time. Features included in the suite were: StickyKeys (turn multi-key commands into single key presses), MouseKeys (control of the cursor with a keypad, instead of the mouse), RepeatKeys (adjust how quickly a key repeats when pressed down), SlowKeys (adjust how quickly the computer responds to a key press), BounceKeys (prevents the computer from responding to an accidental double-tap of a key), ToggleKeys (provide an audio indication when lock keys, such as capslock or numlock, are pressed down), SerialKeys (allow adaptive input devices to be recognized through the computer's serial port), and ShowSounds (provide a visual display when the computer makes an error beep), and TimeOut (allow AccessDOS features to turn off, so that a computer can be shared with users who do not need the features).[391]

The IBM Personal System/2 (PS/2) would replace the PC as IBM's leading personal computer system and its first with a graphical user interface, in 1987. A focus on accessibility in the company led to some accessibility features becoming integrated into

---

390 “User's Guide for AccessDOS.” IBM, last modified January 21, 1997, accessed August 29, 2012. ftp://ftp.software.ibm.com/sns/accessd.zip.

391 Ibid. And "IBM Independence Series" brochure.

the PS/2 as standards, instead of only available as aftermarket add-ons or through tinkering with the technology. For example, the machine had its power switch now located on the front of the case, instead of the back, making it easier to reach—a feature that people with mobility impairments had been requesting since the first personal computers. The PS/2 keyboard also had nibs on the F and J, a tactile feature to help people with visual impairments quickly place their fingers on the correct keys, but which has become a standard that benefits all computer users.[392] It also came with a computer monitor which could be tilted, to allow the screen to be adjusted to fit users at any angle —a feature designed for people with cerebral palsy. According to an article in *Think*, the PS/2 had 32 accessibility features built into it, most of which benefited all users of the computer.[393] This awareness of accessibility features making the computer more usable for everyone increased during the 1980s and 1990s, culminating in the tenets of universal design I discussed in the Introduction.

The successor to the IBM Screen Reader, the Screen Reader/2 for the PS/2 personal computer, was developed by IBM's Special Needs System group, between 1988 and 1991, and marketed by its National Support Center for Persons with Disabilities. It was the first product in IBM's Independence Series and marked the turn from creating screen readers mainly for their own employees to developing it as a consumer technology.[394] Thatcher led the development of Screen Reader/2, which was tested by and initially designed to fit the needs of blind IBM employees.[395] One of the features that

---

392 Divoky, "Curb Cuts for Computers," 48.
393 Kafer, "A Fair Chance," 45.
394 IBM National Support Center for Persons with Disabilities. *Technology for Persons with Disabilities,* 15.
395 Kafer, "A Fair Chance," 45.

emerged from user feedback was Autospeak, which allowed the screen reader to detect changes on the screen, such as error or status messages, and automatically read them to the user.[396] Turning from IBM employees to the wider blind population, Thatcher communicated with the larger blind public during the development of Screen Reader/2, by demonstrating prototypes of the technology at National Federation for the Blind conferences in the early 1990s.[397] Screen Reader/2 was operated via a separate 18-key keypad, so that the user's keyboard would not be occupied with control of the screen reader (though the user had the option to use the keyboard if they wished). The user also had control over how much text they wanted read at a time: the entire screen, each paragraph, sentences, individual words, or even each character at a time. Screen Reader/2 was designed to work well with different kinds of software and allowed different application profiles to be set up for each program the user wanted to run.[398] It came with already built-in profiles for some common programs. Working with the graphical user interface, it could also recognize and translate icons and cursor placement.[399] Screen Reader/2 was also able to emulate the function of a mouse with its keypad, by allowing for point-and-click navigation.[400] Though the IBM PS/2 and its operating system, OS/2, would quickly be supplanted in the personal computer market by machines running Windows, IBM's work developing the Screen Reader/2 in communication with the blind community helped to both clarify the needs of blind users to developers and set a bar for

---

396 Ibid., 41.

397 Curtis Chong. “Correspondence on the GUI Problem.” *Computer Science Update*, National Federation of the Blind, Summer 1994. Accessed August 29, 2012. http://cd.textfiles.com/nfbfiles/nfbcs/CS9406.TXT.

398 "IBM Independence Series" brochure.

399 Spechler, *Reasonable Accommodation,* 131.

400 Lazzaro, *Adapting PCs for Disabilities,* 104.

other computer developers to match in meeting the needs of their diverse userbase.

The second Independence Series product was SpeechViewer. Unlike the other accessibility products, SpeechViewer did not provide access to a computer for a user with disabilities, but was instead developed to be used during therapy for people with speech disabilities. It was the product of nearly a decade of research done by IBM's Paris Scientific Center. As with Screen Reader, SpeechViewer was tested by its intended users during its development, in this case at 150 places, including hospitals and schools for deaf people, around the globe.[401] SpeechViewer was intended to support traditional speech therapy by providing the client with computer feedback to different aspects of speech. Its developers described it, in a 1989 conference presentation, as using "gamelike strategies" to encourage the client's progress.[402] There were three types of modules built into SpeechViewer: awareness, skill building, and patterning. Awareness dealt with simple cause and effect reactions to sound, loudness, and pitch. Skill building involved the computer providing feedback to non-language voice aspects, such as pitch, "vowel accuracy," and "vowel contrasting."[403] The patterning modules matched "visual representations of speech attributes" by displaying different representations of aspects of speech.[404]

The third Independence Series product was the IBM PhoneCommunicator. PhoneCommunicator was developed for deaf people to be able to use a computer to

---

401 Adams et al, "IBM Products for Persons with Disabilities," in *GLOBECOM '89: IEEE Global Telecommunications Conference & Exhibition, Dallas, Texas, November 27-30, 1989, "Communications technology for the 1990s and beyond"; conference record* (New York, NY: Institute of Electrical and Electronics Engineers, 1990), 984.

402 Ibid., 982.

403 Ibid., 983.

404 Ibid., 984.

engage in telephone conversations. It worked alongside standard Telecommunication Devices for the Deaf to translate conversations into text and display them on the screen. It also allowed communication between deaf people through the computer. At its core, the PhoneCommunicator was similar to other, earlier computer telecommunication technologies for deaf people, such as those surveyed by Peter McWilliams and Frank Bowe in their mid-1980s books on computer technology for people with disabilities, which I discussed in chapter 3.[405] IBM's product did add some new features, however, such as the ability to act as an answering machine and automatically record messages for the user.

The next Independence Series product, THINKable, was similar to SpeechViewer in that it was developed to work with medical professionals treating people with disabilities, in this case for people with cognitive disabilities. THINKable both provided skill practice exercises to be used during therapy and case management capabilities for medical professionals to manage their clients. Its focus was on improving four aspects of memory: Visual Attention, Visual Discrimination, Visual Memory, and Visual Sequential Memory.[406] THINKable used multimedia clips, such as pictures and recorded speech, to provide different sensory stimuli. The case management functions included data collection, analysis tools, and reporting.

The final Independence Series product I discuss, VoiceType, was released in 1994. It was a voice command system for a personal computer that allowed the user to navigate and control the computer using speech, instead of a keyboard and mouse. VoiceType was

[405] McWilliams, *Personal Computers and the Disabled,* 14 and 56 and Bowe, *Personal Computers and Special Needs,* 19.

[406] IBM National Support Center for Persons with Disabilities. *Technology for Persons with Disabilities,* 25.

available for DOS, OS/2, and Windows. In 1996, a popular and simplified version of the software, VoiceType Simply Speaking, was offered for Windows 95 and intended for home and school use.[407] VoiceType was capable of adaptive learning to fit each user's unique speech patterns and allowed multiple users to store their profiles on one system. It had a vocabulary of more than 22,000 words. VoiceType Dictation, the full, professional version of the software, came with specialized vocabulary for journalists, doctors, and lawyers.[408] It was also available for multiple languages: English, Italian, Spanish, German, and French. As with Screen Reader/2, VoiceType came preset with commands for popular software applications, such as Lotus Notes, Lotus 1-2-3, Microsoft Excel, Word, and Quicken, and included accessible documentation, so that the user could access help files on their own. Users could perform complicated commands by setting up their own multi-step commands using voice macros that could store up to 1000 keystrokes in a single voice command.[409]

The accessibility work done within IBM during the 1980s and 1990s was, to a large extent, focused on employees—either IBM's own or the training of people with disabilities for computer-related careers. The company slowly worked to produce technologies to benefit all people with disabilities, both products that allowed people to access the personal computer and software that was designed to augment therapy. IBM's accessibility work brought users into the development process; employees with disabilities who might use the products being developed and external potential users

---

407 "IBM VoiceType Simply Speaking Brings Speech Recognition Technology to Home, School, and Mobile Office," IBM Software Announcement, Letter Number 296-434, October 29, 1996, accessed August 29, 2012, http://www.www-304.ibm.com/jct01003c/cgi-bin/common/ssi/ssialias?infotype=an&subtype=ca&htmlfid=897/ENUS296-434&appname=xldata&language=enus.

408 Lazzaro, *Adapting PCs for Disabilities,* 80.

409 "IBM Independence Series" brochure.

tested products and supplied feedback on desired features. Products were also designed so that users could work with them independently, with software documentation and help files made to work in the same manner as the software, be it read aloud to the user with Screen Reader or navigable by voice with VoiceType. IBM's accessibility efforts, however, were not only internally focused during this time; IBM has also had contact with and participated in projects with external disability and technology organizations across the country—connections which would grow in the early 1990s.

Both IBM and Apple dedicated company resources to improving personal computer accessibility for people with disabilities during the 1980s and 1990s. There were, however, a number of significant differences between the two companies that impacted how they developed accessible technologies and worked with disability activist organizations. The differences between Apple and IBM mainly pertained to the companies' respective sizes during this time period. Compared to Apple, IBM was, of course, a far larger company. IBM developed a large variety of computer products, while Apple focused on personal computers. Many of IBM's computer accessibility features were developed internally in order to make its own technology accessible to IBM employees with disabilities. IBM had existed since the early twentieth century and developed some of the earliest computer technology, whereas Apple was founded with the invention of the personal computer in the late 1970s. Both IBM's development of personal computers and work with people with disabilities were a part of the company's long history. IBM had a reputation that was both changing and dependent on the perspective from which they were viewed,[410] giving IBM incentive to control their public

[410] For example, while IBM computers were wildly successful among businesspeople, Apple's critical

perception where possible. Apple came into the personal computer market as a new company, with strong ties to the counterculture and an aura of technological user-friendliness. The computer for Apple and its customers was a symbol of individualism and freedom: values which Apple embedded into their machines in a bounded way, which proscribed certain options for the user and blocked others. Finally, IBM was geographically diverse, with different parts of the company located across the globe, while Apple had a single headquarters in the Bay Area. This latter difference—of geography and local culture—impacted both how the companies related to external disability organizations and how, internally, they organized their own efforts to develop and promote accessible technologies.

During the late 1980s and early 1990s, disability and technology activist groups, such as the ATA, sought to transmit knowledge of the potential of personal computer technology to people with disabilities, disability professionals, educators, and legislators. Apple Computer formed the ATA to create a national network of local disability and technology organizations, so that their expertise and resources could be more effectively pooled and distributed. The ATA functioned as a bridge between computer users with disabilities and technology developers to disseminate knowledge and communicate needs. The Alliance demonstrated two levels at which such a social technology could operate. At the national level, the ATA connected organizations together and ran large-scale programs. At the local level, the individual member centers, such as the DCCG,

---

comparison between IBM and Big Brother struck a chord with the type of people who constituted Apple's customer base.

directly worked with individuals to find solutions to their problems. While the ATA was growing and expanding, from its foundation within Apple to an independent non-profit organization, IBM was also working toward promoting accessible personal computer technology, by connecting with advocacy groups to help get computers into the hands of users and by developing their own accessible technologies for both their employees and consumers. At the same time the ATA and IBM expanded their accessibility operations, the disability rights movement was also regaining strength, leading up to the passage of federal legislation to more forcefully secure civil rights protections for people with disabilities, as I will discuss in the next chapter.

Chapter 5

The Growth of Disability Rights and Accessible Computer Technologies

After diminishing in strength since the mid-1970s, the disability rights movement experienced a resurgence beginning in the late 1980s; this regrowth propelled the passage of new disability rights legislation that affected the use and development of accessible computer technologies for people with disabilities. This resurgence culminated in the passage of the Americans with Disabilities Act of 1990, guaranteeing people with disabilities protection from discrimination in a far broader and more enforceable way than Section 504 of the Rehabilitation Act of 1973, which I discussed in chapter 2. As a part of this greater protection of civil rights, technological accommodations were again shown as the means through which people with disabilities could enjoy protection from discrimination and full participation in society. Disability and technology advocacy groups, such as the Alliance for Technology Access and its member centers, took part in arguing for the passage of this new legislation and benefited from its enactment, as they moved on to bigger projects reaching more people with disabilities and connecting them with computer technology that could help them.

In this chapter, I situate attempts to improve accessible personal computer technology within the larger context of the disability rights movement and its resurgence in the late 1980s. I begin with a defining moment that advanced the cause of disability rights and placed it firmly in the public eye: the student protests at Gallaudet University fighting for the selection of a deaf president. I examine the roles played by advocacy groups in the passage of two important pieces of federal legislation that were passed during this period, which guaranteed the rights of people with disabilities and increased their access to assistive technologies: the Technology-Related Assistance for Individuals with Disabilities Act of 1988 (Tech Act) and the Americans with Disabilities Act of 1990 (ADA). I then turn to the effects the ADA had on groups such as the Alliance for Technology Access (ATA) as new attention and visibility enabled it to turn to bigger projects than before. I discuss the ATA's relationship with the computer industry in the early 1990s, as IBM replaced Apple Computer as their main corporate supporter. I conclude with a comparison between the work done on accessibility at both IBM and Apple and the different roles they played in both philanthropic efforts and the development of consumer products for people with disabilities.

5.1 The 'Deaf President Now' Protest at Gallaudet

In the late 1980s, the disability rights movement, which had been mostly stagnant for a decade, experienced a resurgence in strength on a national-scale in the form of both public protests and federal legislation, with implications for the use of technology by people with disabilities. A growing sense of identity helped to urge this movement forward, as groups of people with common disabilities and similar struggles joined together to fight for greater equality. One of the defining events of the disability rights movement that garnered national attention and helped spur momentum into the eventual passage of legislation such as the Americans with Disabilities Act was the 'Deaf President Now' protest at Gallaudet University in 1988. There were a number of reasons that this protest—demanding the first deaf president in Gallaudet's 125 year history—occurred at this time. The population of deaf people in the U.S. had skyrocketed in the 1960s after the combination of a rubella outbreak and medical advances that allowed the patients to survive but with hearing loss led to the doubling of the number of deaf children in the country.[411] These children, and all other children with disabilities, would go on to benefit from the 1976 passage of the Education for All Handicapped Children Act and graduate from high school with a higher standard of education than people with disabilities had previously experienced. This population of students would be college-aged in the 1980s, with higher expectations and large numbers that gave their demands for equal rights a louder voice. At the same, Deaf[412] activism had grown, fighting to preserve Deaf culture and its use of American Sign Language for communication. More generally, the cumulative effects of disability rights legislation during the 1970s that granted civil rights protections to all people with disabilities, though often unenforceable, would make the fulfillment of new demands a real possibility.

In his history of the disability rights movement, Joseph Shapiro describes the week-long Gallaudet protests as “a defining moment.” Unlike the protests over the Section 504 legislation in the 1970s, which were scattered across the country and did not receive national recognition, the Gallaudet protests were covered by the national media.[413] At the heart of the protests were student demands that the 124-year-old Galluadet

411 Shapiro, *No Pity,* 85.

412 Capital-D Deaf is used to refer to the Deaf rights movement, while lowercase-d deaf is used to refer to deaf people in general.

413 Ibid., 74.

University, in Washington DC—the only university in the world for the deaf and hard of hearing—appoint its first ever deaf president. In December, 1987 the previous Gallaudet president, Jerry Lee stepped down; a group of Gallaudet alumni planned for a rally on March 1, 1988 to bring the students, faculty, and staff together in encouraging the administration to choose a deaf successor. The fliers for the rally explained their position: "With a deaf person in the position of leadership, one that has the same views, experiences, and needs that we do, people will become more informed of the needs of deaf people."[414] The protesters were backed by Vice-President George Bush, Senators Bob Dole (R-KS), Bob Graham (D-FL), Tom Harkin (D-IA), Paul Simon (D-IL), Lowell Weicker (R-CT), Congresswoman Patricia Schroeder (D-CO), and Reverend Jesse Jackson, all of whom sent letters to the Gallaudet Board of Trustees in early March supporting the choice of a deaf president for the federally-funded university.[415] Simon, in particular, clarified why having a deaf president for Gallaudet mattered: "A fundamental requirement, overriding any other for this job, is an understanding of deafness—what it is and how it affects the educational experience."[416] After 124 years of a hearing person running the deaf university, the students of Gallaudet would no longer allow themselves to be represented by someone who was not like them.

The university announced the three finalists for the vacant position the day of the

---

414 "Flyer distributed at the March 1, 1988 Rally," Gallaudet University. Accessed August 29, 2012. http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/DPN_Home/Issues/Related_Documents/RallyFlyers.html.

415 All letters can be found at http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/DPN_Home/Issues/Letters_of_Support/Senator_Paul_Simon.html.

416 Paul Simon, Paul Simon to Greg Hlibok, Washington, DC, March 10, 1988, in *Letters of Support,* Gallaudet University, accessed August 29, 2012. http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/DPN_Home/Issues/Letters_of_Support/Senator_Paul_Simon.html.

rally: Dr. I. King Jordan (the deaf dean of the college of arts and sciences), Dr. Harvey Corson (the deaf president of a school in Louisiana), and Dr. Elisabeth Zinser (an administrator at the University of North Carolina and the only hearing candidate).[417] On March 6, the Board of Trustees announced that they had chosen Zinser, who did not know sign language, as president. Mass student protests broke out immediately following the news, and the following day students blocked all campus entrances with hot-wired cars and buses, closing down the university. The Gallaudet students, faculty, and staff issued a vote of no confidence in the Board of Trustees, calling for the appointment of one of the deaf finalist candidates, the resignation of Board chairwoman, Jane Spilman, the alteration of Board by-laws to require a majority deaf representation on the Board, and no reprisals against those involved with the protest.[418] Spilman had become a target, not only for announcing Zinser's appointment, but for being quoted as saying "Deaf people are not ready to function in a hearing world." Though she denied ever saying it, the quote was picked up and printed repeatedly during the national press coverage of the protests.[419] Classes technically resumed the following day, though ninety percent of students boycotted and continued protesting. Students at other deaf schools across the country and Gallaudet alumni joined the protest.[420] Zinser was prevented from coming to campus or speaking to the student body, which refused to legitimize her authority as president.

The protesters approached the federal government for support and won it; on

417 Shapiro, *No Pity*, 77.
418 President's Council on Deafness, "Position of the Students, Faculty and Staff of Gallaudet University," Gallaudet University, accessed August 29, 2012, 79. http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/DPN_Home/Issues/Related_Documents/PCD_Demands.html.
419 Shapiro, *No Pity,* 78.
420 Ibid., 80.

March 9, the front page of the Washington Post declared Congressional support for a deaf Gallaudet president. Representative David Bonior (D-MI), a Gallaudet Board member, was quoted on the issue of Gallaudet's future funding if Zinser stayed president: "I'm concerned it has the potential to hurt the funding of the university, especially when you have leaders from both parties going out of their way to express themselves on this."[421] That evening, on ABC *Nightline,* Ted Koppel interviewed Zinser and student body president Greg Hlibok. The following day Dr. I. King Jordan retracted his previous support of Zinser's appointment as President. Later that day, Zinser publicly resigned. The protest continued, including a march to the Capitol Building, until March 13, when the rest of the Deaf President Now protest's demands were met with Spilman's resignation and Jordan named Gallaudet University's first deaf president.[422]

One of the reasons for the Gallaudet students' success was the national attention the protest garnered, what Shapiro calls a "made-for-television solidarity phenomenon, thick with drama."[423] Across the country, American citizens watched a group of young people with disabilities stand up for their rights and demand representation by one of their own. While the American public viewed this protest as being conducted by a group of people with disabilities, and thus, in a way, representing the population of people with disabilities as a whole, the fact that it was by deaf people in particular was significant. Shapiro points out the irony that it was a protest by deaf people which placed disability rights in the public consciousness, as Deaf activists distinguished themselves from people with disabilities by arguing that deafness was a culture, with its own language and means

[421] Quoted in Molly Sinclair and Eric Pianin, "Protest May Imperil Gallaudet Funding: Some Members of Congress Back Movement for Deaf President," *The Washington Post*, March 9, 1988, A1.
[422] Shapiro, *No Pity,* 83.
[423] Ibid., 74.

of communication, not a medical condition. The Deaf movement had historically distanced themselves from disability rights with the argument that deafness was not a disability. However, from the perspective of larger society, deaf people faced the same discrimination as people with disabilities, needed technological accommodations in order to fully participate in society, and were part of the same struggle for civil rights and equal opportunities.[424] Congressman Tony Coelho described Gallaudet as a catalyst for the disability rights movement: "It is time, I think, to stand up. I think Galluadet proved that and sort of lit a spark not only with the hearing disabled but with the disability community all over the country. We do not want to be patient anymore."[425] The outcome of the Gallaudet protests would spur the disability rights movement to continued action and public attention; a few months later the Technology-Related Assistance for Individuals with Disabilities Act and the first version of the Americans with Disabilities Act would be introduced before Congress.

5.2 Technology-Related Assistance for Individuals with Disabilities Act of 1988

As the energy of the disability rights movement surged forward with a population of college-aged adults with disabilities who had grown up reaping the benefits of disability rights legislation from the 1970s, disability activists and proponents within the federal government pushed for the passage of two significant pieces of legislation: the

[424] Ibid, page 85.
[425] *Americans with Disabilities Act of 1988: Joint Hearings on S. 100-926, Before the Subcommittee on the Handicapped of the Comm. on Labor and Human Resources United States Senate and the Subcommittee on Select Education of the Comm. on Education and Labor House of Representatives*, 100th Cong. (1988), 36.

Technology-Related Assistance for Individuals with Disabilities Act of 1988 (Tech Act) and the Americans with Disabilities Act of 1990 (ADA). The Tech Act is not included in most histories of the disability rights movement. It was smaller and more specifically focused than the ADA; the Tech Act only dealt with assistive technology for people with disabilities in the form of grants offered to states to get technology to people who might need it. The Tech Act may also receive less notice because it was uncontroversial and passed through Congress quickly and with bipartisan support. However, it was a vital piece of legislation for disability-and-technology advocates, and is frequently written about in their own materials. It provided federal funding to programs that helped connect people with disabilities and assistive technologies to benefit them. It allowed groups, such as the ATA, to work directly with government agencies and receive funding for larger projects to promote technology for people with disabilities.

As with the development of many accessible technologies I have discussed, the Tech Act was supported by people in Congress who had personal connections with issues of disability rights. Tom Harkin (D-IA), the chairman of the Senate Subcommittee on the Handicapped, introduced the bill. Harkin, whose brother was deaf, was a major proponent of disability rights and the only U.S. Senator proficient in American Sign Language. Harkin described the passage of the Tech Act as: “Following two days of testimony on how technology has already helped the disabled to lead productive lives, it became clear that America needs a comprehensive, responsive, and coordinated system to stimulate new developments and make them accessible and affordable to disabled people.”[426] The Tech Act would create this new system of technological development and accessibility by

[426] Tom Harkin, "A View from Capitol Hill," PC/Computing, July 1989, 91.

promoting and funding programs at the state level, which would provide assistive technology and training for people with disabilities. Assistive technology was defined by the bill as any device "that is used to increase, maintain, or improve functional capabilities of individuals with disabilities."[427] This included both off-the-shelf and customized technologies.

Disability rights legislation passed during the 1960s and 1970s made the argument that technology provides access to social participation for people with disabilities and that technological accommodations are necessary for equal opportunities in society; the Tech Act followed in the footsteps of these earlier laws concerning the need for accessible technologies. The necessity of the Tech Act at this time was based on findings that technology was a necessary part of people's lives and, in particular, enabled people with disabilities to:

> (A) have greater control over their own lives;
> (B) participate in and contribute more fully to activities in their home, school, and work environments, and in their communities;
> (C) interact to a greater extent with nondisabled individuals; and
> (D) otherwise benefit from opportunities that are taken for granted by individuals who do not have disabilities.[428]

Beyond the benefits assistive technology could impart to people with disabilities, the Tech Act also acknowledged that there was a monetary benefit to both individuals with disabilities and society as a whole. In the bill, Congress argued that the use of assistive technology would reduce the cost of social activities such as education, health care, transportation, and telecommunications for individuals with disabilities, their families,

---

427 Technology-Related Assistance for Individuals with Disabilities Act of 1988, Pub. L. No. 100-407 (1988), Section 3.
428 Ibid., Section 2a.

and society. This finding is not backed up with evidence, but the argument seems to be that effective assistive technology would enable people with disabilities to take part in various aspects of society in a way that is cheaper than if people lacked such technology or had to use less effective technology. Harkin described the cost savings of the Tech Act in an article after the bill was passed: “Today, the federal government funds hundreds of millions of dollars in unemployment disability payments to persons who could be employed if they had access to assistive technology. Investments in technology to keep people working can save taxpayers and employers much of the cost of long-term disability payments.”[429] At a time when there was a workforce shortage in the U.S., the promise of the Tech Act leading to more employable people with disabilities offered a concrete, monetary benefit to the nation as a whole and offset the costs of implementing the bill.

The arguments made in the Tech Act marked a step along the slow shift away from paternalism in how U.S. society viewed people with disabilities. No longer were they the 'deserving poor,' who needed charity to survive. Assistive technology could enable people to more fully participate in society, bridging the social divide between people with disabilities and those without. At the same time, however, the language of the Tech Act also differs from earlier rehabilitation legislation, which necessitated the funding of programs that would make people with disabilities employable and thus, pay back some of the welfare cost society bore to help them. While the cost-saving arguments in the Tech Act do concern employment and the reduction of disability payments to people who could work if they had access to technology, the bill does not address this in

[429] Harkin, "A View from Capitol Hill," 91.

terms of needing to rehabilitate or fix the individual in order for them to be employable. Instead, the problem is located in the lack of available assistive technology and the money that is wasted on welfare when it could be more efficiently spent on providing people with the means of employment; solving the problem involves funding programs that will distribute technology to people who are blocked from social participation without it. In addition, the Tech Act focuses on the full range of social activities, beyond only employment, and insists on the necessity of assistive technology in allowing people with disabilities to experience fuller lives.

The legislators behind the Tech Act recognized the positive effects that already existing technology could have on people's lives, and also sought to solve the need for technology that was not being fulfilled. Similar to the arguments made by the DCCG and NSEA, the Tech Act spelled out the problem of a lack of knowledge preventing people from accessing technology, in addition to issues of cost and government coordination.

> There is a lack of-
> (A) resources to pay for such devices and services;
> (B) trained personnel to provide such devices and services and to assist individuals with disabilities to use such devices and services;
> (C) information about the potential of technology available to individuals with disabilities, the families or representatives of individuals with disabilities, individuals who work for public agencies and private entities that have contact with individuals with disabilities (including insurers), employers, and other appropriate individuals;
> (D) coordination among existing State human services programs, and among such programs and private agencies, particularly with respect to transitions between such programs and agencies; and
> (E) capacity of such programs to provide the necessary technology-related assistance.[430]

This argument describes the lack of a social technology to communicate information on

---

[430] Technology-Related Assistance for Individuals with Disabilities Act of 1988, Section 2a.

technology to users, which I discussed in chapters 3 and 4 in relation to the ATA and DCCG. The Tech Act was addressing the need for such a social technology on a far larger scale than even an umbrella disability and technology advocacy network like the ATA. What was needed was a way to coordinate communication efforts across the entire country and include government agencies, individuals with disabilities, and people with technical knowledge. This problem of lack of access to technology was compounded by what the Tech Act described as a lack of motivation for technology companies to develop products aimed at consumers with disabilities, as a result of a perceived limited market. The bill also explained that federal agencies lacked the coordination to provide for assistive technology. The solution created by the Tech Act was to fund state programs that would increase awareness of technological needs of people with disabilities, increase technological knowledge for people with disabilities and other people in their lives, explore procedures that were either providing for assistive technology or blocking access to it, coordinate state agencies and private entities to provide technology, and, overall, increase the opportunities for people with disabilities to access assistive technology. At the federal level, the Tech Act would also work to uncover policies which enabled or impeded funding of assistive technology, remove obstacles to funding, and improve the federal government's ability to supply the states with assistance in providing assistive technology.[431]

The Tech Act was not a strictly top-down legislation created by politicians; disability activists played a role in enacting this new policy. The Alliance for Technology Access was involved with the Tech Act both before its passage and after the federal

[431] Ibid., Section 2b.

government began doling out grants to state programs. In spring of 1988, the Alliance Planning Team, through its connections with Apple Computer, submitted written testimony to Congress about the Tech Act prior to its passage.[432] Most of Apple's concerns dealt with the need to achieve equity and the possibility of doing so through the availability of adaptive technologies that could allow people with disabilities to more fully participate in society. The company—and the NSEA—argued that legislation was needed to make technology available, especially to those people who fell through the gaps of service providers:

> Concern for equity cuts across many of these questions and is a central issue in barrier-free technology. Often, the people who should benefit most from adaptive technology are the people who can least afford it. Many children and adults with disabilities are blocked from accessing [useful] technology in their communities because they belong to the wrong age group, disability group, socioeconomic group or educational services group.[433]

Any federal legislation that provided assistive technology needed to find a way to reach those people who had difficulty affording it or were left out of current technology distribution methods. From Apple's perspective, the Tech Act needed to provide technology for the people who could benefit from it, as a way to work toward equity in society for people with disabilities: "We firmly believe that a program which provides loaned, free or reduced priced equipment; assists consumers in seeking public and private funding; or enables individuals with disabilities to qualify for a low cost or subsidized loan program is necessary for equity and should be a substantial part of this legislation."[434] The existence of assistive technology itself was again not enough; though

---

432 *Technology-Related Assistance for Individuals with Disabilities Act of 1988: Hearings on H.R. 4904, Before the Subcommittee on Select Education of the Comm. on Education and Labor*, 100th Cong (1988) (statement of James Johnson, Director of Government Affairs, Apple Computer, Inc.).

433 Ibid., page 56. Bad copy, my best guess of the word used.

434 Ibid., 57.

the focus here is on monetary cost, not lack of information, technology still needed to be better made available to people with disabilities who could benefit from it.

To give the federal legislation a model to emulate, Apple argued that the NSEA offered a positive example of an organizational structure that was capable of reaching people. One of the major reasons for the NSEA's success, according to Apple, was its core partnership between consumers and industry professionals.

> We believe that the inter-disciplinary, cooperative approach characteristic of the NSEA is a critical component in any comprehensive adaptive technology legislation. We believe that the NSEA model takes advantage of systems, organizations, and structures that are currently in place, and introduces new technology and information on a daily basis. The model of the NSEA is especially intriguing because it represents both a healthy partnership between the public and private sectors and a community-based, collaborative approach for getting everybody to work together.[435]

The NSEA's network enabled it to take advantage of systems of expertise already in place, and connect them together to better share knowledge; its network allowed it to function on multiple levels—from one-on-one community work, to local groups working with each other, to larger, national projects that attempted to reach many people at once. Apple also emphasized, in particular, the role of consumers with disabilities and the parents of children with disabilities as crucial to success.[436] Apple argued that such a model would provide significant strengths to the funding network the Tech Act would construct, which the NSEA, in the form of the Alliance for Technology Access, would continue to work with after the passage of the bill and reap the benefits of.

The Tech Act directly impacted disability and technology advocacy efforts around the country, including the newly independent Alliance for Technology Access. After the

---

[435] Ibid., 56.
[436] Ibid., 57.

Tech Act passed, the federal government began giving out a certain number of grants to states each year. By 1993, 42 states had received Tech Act grants. Bob Glass explained that 42 ATA centers had, at that time, been in contact with the assigned agency in their states and that 19 centers were receiving some amount of Tech Act funding through their state agency.[437] As the Tech Act expanded its coverage across the country each year (by 1995, all 50 states were covered), the ATA responded by including more centers in more states under its purview. In addition, in 1990, the ATA began the ACTION Project (Accessing Computer Technology In Our Neighborhoods), funded by a grant from the U.S. Department of Education under Title II of the Tech Act.[438] The project planned to involve five resource centers over three years and focused on technology for people with low-incidence disabilities.

5.3 The Americans with Disabilities Act of 1990

While the Tech Act was a great boon for efforts to promote accessible and assistive technologies for people with disabilities, its success would be eclipsed two years later with the passage of the more general anti-discrimination legislation, the Americans with Disabilities Act of 1990 (ADA). Though the ADA was passed in 1990, marking what was arguably the greatest success of the disability rights movement, its development had been in process throughout the late 1980s. The ADA's direct origin began in 1986

[437] Annual report. "1992 Program Impact Report: Redefining Human Potential: The Partners, Progress and Promise of the Alliance for Technology Access" Bob Glass, Jackie Brand, Mary Lester, Foundation for Technology Access, box 1, folder 5, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley.

[438] Newsletter. ATA Perspectives v. 2 [no date] Albany, CA: Foundation for Technology Access, eds. Jackie Brand, Mary Lester, Mary Lou Sumberg, box 2, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 4.

with the publication of "Toward Independence: An Assessment of Federal Laws and Programs Affecting Persons with Disabilities—with Legislative Recommendations," a report by the National Council on the Handicapped to the President and Congress.[439] This report was the result of the Rehabilitation Act Amendments of 1984, which established the National Council on the Handicapped as an independent federal agency, tasked with reviewing the efforts of federal programs related to people with disabilities and recommending ways to improve them.[440] The Council was made up of fifteen independent experts in disability issues. One of the main conclusions they reached in their report was that "Federal disability programs reflect an overemphasis on income support and an underemphasis of initiatives for equal opportunity, independence, prevention, and self-sufficiency."[441] In contrast to the limited scope and problems with enforcement of Section 504, the federal government was now beginning to recognize the disability rights movement's call for civil rights and access to full participation in society. In the report, the Council recommended the enactment of an equal opportunity law for people with disabilities, on the basis that "If the goals of independence and access to opportunities for people with disabilities are to be achieved, it is essential that unfair and unnecessary barriers and discrimination not be allowed to block the way."[442] The Council argued that existing laws (including Section 504) were inadequate and not broad enough, as compared to anti-discrimination laws for other population groups. They called for a law that would make it clear to society as a whole that discrimination against people with

[439] National Council on the Handicapped, *Toward Independence: An Assessment of Federal Laws and Programs Affecting Persons with Disabilities—with Legislative Recommendations* (Washinton, D.C.: National Council on the Handicapped, 1986).

[440] Rehabilitation Act Amendments of 1984, Pub. L. No. 98-221, 98 Stat. 26 (1984), 142.

[441] National Council on the Handicapped, *Toward Independence*, 12.

[442] Ibid., 18.

disabilities was unacceptable. They suggested that such a law be called The Americans with Disabilities Act and apply to all federal departments, all federally funded programs, all employers with more than fifteen employees, all landlords and providers of housing, all public accommodations, all interstate transportation businesses, all insurance providers, and all state and local government agencies.[443] To not repeat the problems with legislation such as Section 504 of the Rehabilitation Act, this new law should also have specific enforcement policies.[444]

Two years later, in January 1988, the National Council on the Handicapped followed up on their previous report with a new assessment: "On the Threshold of Independence: Progress on Legislative Recommendations from *Toward Independence.*"[445] Included in this report was a draft of proposed legislation called the Americans with Disabilities Act of 1988. The Council found that in the previous two years, eighty percent of their recommendations had been at least partially accomplished; twenty-one statutory provisions had been enacted and a further eight bills had been introduced to Congress which would help accomplish the goals set out in the previous report.[446] Public consciousness toward disability rights had increased during the previous two years; "Toward Independence" had found favor in both the disability community and the general public, and the report was mentioned in the national news.[447] With progress being made in many areas, the main recommendation became the "enactment of a clear and

443 Ibid., 19.
444 Ibid., 20.
445 National Council on the Handicapped, *On the Threshold of Independence: Progress on Legislative Recommendations from* "Toward Independence" (Washinton, D.C.: National Council on the Handicapped, 1988).
446 Ibid., xiii and xviii.
447 Ibid., 4.

comprehensive statute guaranteeing equal opportunities for people with disabilities"[448]—a goal the ADA would come to fulfill.

The first version of the ADA was introduced to Congress on April 28, 1988 and was written by Robert L. Burgdorf Jr., a disabled attorney and Research Specialist for the National Council for the Handicapped.[449] Its sponsors in the House of Representatives and Senate were, respectively, Tony Coelho (D-CA) and Lowell Weicker (R-CT). Both men had experience with the discrimination faced by people with disabilities: Coelho as a man with epilepsy and Weicker as the father of children with disabilities.[450] A joint hearing of the proposed bill was held before House and Senate subcommittees on September 27, 1988.[451] Present were Senators Tom Harkin, Edward Kennedy, Lowell Weicker and Representatives Major Owens, Tony Coelho, Matthew Martinez, and James Jeffords. Expert testimony on the subject of discrimination toward people with disabilities was given by witnesses, including an account of the Gallaudet Deaf President Now protests by Greg Hlibok.

The efforts of all the people fighting for civil rights protections for people with disabilities would culminate with a law that would change the way people with disabilities fit into American society. Congressman Major Owens (D-NY) described the change: "This legislation grants full rights to Americans with disabilities and moves our great Nation from a respectable position of official compassion for those with impairments to a more laudable position of empowering disabled Americans."[452] The

---

448 Ibid., 23.
449 Shapiro, *No Pity,* 108.
450 Ibid., 118.
451 *Americans with Disabilities Act of 1988: Joint Hearings on S. 100-926.*
452 Ibid., 4.

concern with empowerment echoes disability rights legislation from the 1970s, such as Section 504; empowerment moves firmly away from the medical model of disability legislation, where people with disabilities were the deserving poor to be cared for by society, to a civil rights view of disability, where people with disabilities are capable of and encouraged to fully participate in society. Owens went on to give credit for development of the ADA to the disability rights movement and cited the Gallaudet protests as an event which had made the movement "highly visible."[453] Coelho echoed the role of the Gallaudet protests and the disability rights movement for him personally:

> What happened at Gallaudet University was an inspiration to all of us with disabilities, in that if we ourselves believe in ourselves and are willing to stand up we can make a difference. That is what this bill is all about; 36 million Americans deciding it is time for us to stand up for ourselves, to make a difference, to say that we want our basic civil rights also. We deserve it.[454]

Judy Heumann—a leader of the Independent Living Movement for whom Jackie Brand worked at the Center for Independent Living—gave testimony expanding upon why this was the time for legislation such as the ADA to come to pass: "I personally think that the Gallaudet experience and the 1977 demonstrations in relationship to 504 and the subsequent Development of Independent Living centers and community-based organizations around the United States, and the real true emergency of a rights movement are going to compel the United States to recognize its responsibility."[455] These statements demonstrate one of the strengths behind the disability rights movement that made it powerful enough by the late 1980s to have legislation like the ADA in consideration before Congress—what Shapiro calls the "hidden army" of people with disabilities and

---

[453] Ibid.
[454] Ibid., 12.
[455] Ibid., 86.

their advocates. He explains that one out of seven Americans were to be covered by the ADA when it passed in 1990; the sheer ubiquity of people with disabilities made them a population that had a presence everywhere.[456]

This strength of numbers was not enough to pass the first version of the ADA, as it was written, but two years later it would play an essential role in the legislation finally being enacted in law. Part of the issue was timing. The joint hearing on the ADA took place less than a month before the end of the 100th Congressional term. Shapiro argues that legislators were concerned with coming elections, while the Reagan administration was winding down and distracted by other issues.[457] There was also no press coverage of the 1988 bill. The poor timing was not unanticipated or unplanned for, however. The National Council on Disability (the successor to the National Council for the Handicapped) produced a history of the development of the ADA[458] that describes the timing as a strategy to take advantage of the coming Presidential election, by eliciting the candidates' support for the ADA while they were competing with each other. This worked particularly well with Vice-President George Bush, who gave repeated, public support for people with disabilities and courted their votes during his campaign.[459] Harkin explained the plan for the ADA during the 1988 joint hearing, that progress would not be made on the bill that year, and the intention was to reintroduce the ADA the following year for the 101st Congressional term.[460] Though the 101st Congress was the one to eventually pass the ADA, the entire process of negotiation and rewriting lasted until their second session

---

456 Shapiro, *No Pity,* 117.
457 Ibid., 114.
458 National Council on Disability, *Equality of Opportunity: The Making of the Americans with Disabilities Act* (Washington, D.C.: National Council on Disability, 2010).
459 Ibid., 68-69.
460 *Americans with Disabilities Act of 1988: Joint Hearings on S. 100-926,* 91.

in 1990 and it would be an altered version of the bill that passed, with new champions behind it.

Shapiro's “hidden army”—the massive, though mostly disorganized population of people with disabilities in the U.S.—would play a major role in enabling the passage of the Americans with Disabilities Act of 1990. As people with disabilities experienced a growing awareness of their group identity and common struggle for equal rights, disability activists across the country and in Washington worked to mobilize them to defend the bill. Two of the main strategists trying to influence the government were Pat Wright (Judy Heumann's assistant during the San Francisco 504 protest sit-in in the 1970s) and Ralph Neas (a prominent civil rights attorney).[461] The ADA brought together disability rights advocates with broader civil rights advocates to join forces in securing enforceable civil rights legislation for people with disabilities. Within the federal government, Shapiro emphasizes that many of those involved with the ADA were either themselves disabled or had close family members with disabilities, including Senators Tom Harkin, Edward Kennedy, Bob Dole, Orrin Hatch, and Representative Steny Hoyer.[462] Even the newly elected President George H. W. Bush had experience with disabilities in his family, with a daughter who had died in infancy of cancer and a son who had learning disabilities.[463]

The final version of the ADA that passed in 1990 only succeeded because of changes made to it from the previous version. The first version of the ADA was more

---

[461] National Council on Disability, *Equality of Opportunity,* 59-60.

[462] Shapiro, *No Pity,* 118. The ADA's previous leaders, Tony Coelho and Lowell Weicker also had personal experiences with disability, but both men were now no longer Congressmen (Weicker lost his reelection and Coelho resigned over a bond investment scandal).

[463] Ibid., 119.

radical and seen by Harkin and Kennedy to have little chance of being passed.[464] It had stipulated that all buildings and public transportation vehicles had to be made accessible, and the only exceptions were interpreted to mean that a business would be allowed to not make accessibility improvements only if doing so would bring it to the brink of bankruptcy. As opposed to this, the final ADA brought back the Section 504 language of "undue hardship" as defining the exception granted to businesses, to be interpreted on a case by case basis.[465] The removal of barriers was only required for new buildings and vehicles, while existing structures were to be altered only if accessibility was "readily achievable"— if it was not, then alternative services had to be provided for people with disabilities.[466] Other major changes included limitations on legal actions available in discrimination cases and an overall change in tone away from an emphasis on the intolerability of discrimination towards more proactive ways of meeting accessibility standards.[467] The ADA passed the Senate 76 to 8 in late 1989, but House negotiations lasted until May, 1990, when it finally passed 403 to 20. President Bush signed the ADA into law on July 26, 1990, in front of three thousand people gathered on the White House lawn—the most-attended bill signing in U.S. history.[468]

While the ADA was a general anti-discrimination bill, in order for it to be enacted technology would have to play a vital role. The Alliance for Technology Access responded to the passage of the ADA by emphasizing the importance of technology in providing access to equal opportunities for people with disabilities. In an ATA publication

---

[464] National Council on Disability, *Equality of Opportunity,* 79.
[465] Ibid., 81.
[466] Ibid., 82.
[467] Ibid., 80 and 83.
[468] Ibid., 146.

from shortly after the bill was passed, the organization explained its position and desire to work with the ADA:

> Technology is going to play a leading role in the realization of ADA. The Alliance is committed to insuring that the implementation of ADA is not impeded by the lack of awareness and information about the potential of technology to make equality a reality. Working locally and nationally with planners and employers, the Alliance has an important role to play in supporting our new "Declaration of Independence."[469]

According to the ATA, equal opportunity is only possible in our society for people with disabilities via technology. The ATA's view here recalls some of the ideas behind legislation such as the Architectural Barriers Act of 1968—that society has been constructed with barriers in place preventing people with disabilities from full participation. In order for full participation to be possible, those barriers need to be overcome. Technology allows for a means of overcoming barriers, by accommodating the different ways people need to access society and interact with other people. Technology, then, is the tool through which civil rights are made possible for people with disabilities; even if society was designed all along for deliberate universal access and people with disabilities as intended participants, bodies present limitations that technology can accommodate. Equal participation for everyone is only possible if differences in bodies are understood and accommodated.

5.4 The Alliance for Technology Access after the ADA

With the need for technology to enable equal rights for people with disabilities,

---

[469] Newsletter. ATA Perspectives v. 1, August 1990, Albany, CA: Foundation for Technology Access, eds. Jackie Brand, Mary Lester, Mary Lou Sumberg, box 2, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 7.

the passage of the ADA had impact on disability and technology advocacy groups, such as the Alliance for Technology Access. After the passage of the ADA, the ATA continued to grow and expand through the early 1990s, engaging in larger projects related to disabilities and technology and serving more people across the country. Bob Glass estimated that in 1991 alone, the ATA and its centers provided services for around 72,000 individuals and had over 1,000 people with disabilities, parents, and disability professionals in leadership and advisory positions.[470] The network structure of the ATA changed as the organization grew; from a national alliance connecting together small, discrete groups under one umbrella, the ATA began to form different kinds of networks in the form of large-scale national projects. These projects offered different ways of attempting to connect people with disabilities and computer technology that might aid them.

One of the most prominent of the ATA's projects begun in the early 1990s was CompuCID (Computer Classroom Integration Demonstration), a three-year, federally-funded project, which started in 1990, and dealt with the use of computers in supporting the mainstreaming integration of students with disabilities into classrooms with non-disabled students.[471] CompuCID was an important project for the ATA at this time, because both mainstreaming efforts and the development of personal computers converged so that often students with disabilities and personal computers were entering mainstream classrooms at the same time. Both needed to be integrated at the same time. Further, with the use of technology by children with disabilities as technological

---

[470] Glass, " Partners in the Promise of Technology," 136.
[471] ATA Perspectives v. 1, 4.

accommodations which enabled them to participate in mainstream education classes, the introduction of computers into schools was particularly meaningful for those students who would be dependent on the technology as a necessary tool in their education. Educators needed to be trained to incorporate both students with needs they might be unfamiliar with and a new technology they might know little about. Groups like the ATA, which worked with the relationship between disabilities and technology, were poised to instruct educators in the best ways to integrate these children and machines into the classroom.

The CompuCID project involved ATA resource centers working with six public school districts in Colorado, North Carolina, California, Tennessee, and Washington. In each location, CompuCID was run by a Technology Team made up of a local educator and a person with a disability (or the parent of a child with a disability), who both had computer expertise. The project attempted to change both the way students were being taught (using methods such as cooperative learning and cross-age tutoring) and how technology was used in the classroom, in order to integrate both children with disabilities and computers into the curriculum.

The different sites had loose guidelines they had to follow as part of the project; computers had to play a role in integrating disabled and non-disabled children and experiments in cooperative learning had to be tried.[472] The classroom circumstances at the different sites varied widely, however. One of the California classes involved a mix of children for whom English was a second language with children with learning disabilities

[472] Cooperative learning is a teaching method where students work in groups, cooperatively, toward educational goals, while learning from each other.

and one child with severe physical disabilities. The school in Colorado practiced team teaching, whereas the North Carolina program attempted to use computer software to address improvements in basic skill levels.[473] Teachers who took part in CompuCID found that, as it was intended, computer technology played an essential role in classroom integration. A CompuCID newsletter reported on the experiences at one classroom, in late 1990:

> Beth Pitts, a third grade teacher in one of the demonstration classrooms in North Carolina's Cornelius Elementary School, said she has seen the computers serve as a common bond for different types of students in her classroom. “It's been very successful because they (students with disabilities) can do as well as anyone else does in the classroom. The computer puts them at equal.”[474]

The technological accommodation the computer provided allowed these children to be perceived as equals in the classroom. Pitts' comments on computer technology as helping to level the playing field for children echoes the beliefs at the heart of the ATA, that the computer is a universalizing technology which provides new forms of communication which can change the meaning of disability. The computer is a tool that, unlike other traditional education tools that people with certain disabilities would be unable to operate, all the students could use once it was made accessible. Both Pitts and a teacher at the Colorado site went on to praise computer activities in promoting teamwork and a sense of community among the students.

In order to ensure that people with any type of disability could access computer technology—and thus move more toward true universal access, where every type of use is considered and accommodated—the ATA began a project focused on uncommon

[473] Newsletter. Harvey Pressman, “When is Different Really the Same?” *CompuCID* n.1, Spring 1990, box 1, folder 5, Coll. BANC MSS 99/185c, Bancroft Library, University of California, Berkeley, 3-4.

[474] Newsletter. Lauren Terrazzano. “Sights Are High at CompuCID Sites,” CompuCID n.2, Fall 1990, box 1, folder 5, Coll. BANC MSS 99/185c, Bancroft Library, University of California, Berkeley, 2.

disabilities in 1990, the ACTION (Accessing Computer Technology in Our Neighborhoods) Project. Funded by a grant under Title II of the Tech Act, the ACTION project aimed to teach people with low-incidence disabilities about assistive technology that might benefit them. The Alliance was tasked with developing and testing a model for outreach and technological training, with the goal of showing ways computers can improve social integration and independence for people with less common disabilities who had not yet had opportunities to learn about computer technology. The Alliance would use its local resource centers to find ways to connect with people in those communities, as appropriate to their individual needs. The project would utilize outreach and training methods such as: hold technology demonstrations in heavily visited public areas, conduct individual and small-group training sessions, produce videos of people with low-incidence disabilities using technology (to be used by both the individuals themselves and shared with others), and teach individuals with disabilities and their families about assistive technology, funding methods, and relevant legislation that could assist them.[475] The ACTION Project finished in September, 1994.[476] After its conclusion, the ATA developed a manual on outreach methods.[477] Projects such as ACTION, which explicitly address the needs of people with low-incidence disabilities, are necessary for the ideals behind universal design to work; in order to create technology that can be usable by everyone, even uncommon requirements of use need to be addressed.

After the passage of the ADA, the Alliance continued to grow in both the scale of

475 ATA Perspectives v. 2, 4.

476 Annual report. "1994 Program Impact Report: Redefining Human Potential: The Partners, Progress and Promise of the Alliance for Technology Access," Bob Glass, box 1, folder 5, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley.

477 Beth Smith et al., “Real People, Real Technology, Real Solutions,” *The Exceptional Parent*, November, 1994.

projects it could direct and in renown as an advocacy group. As the ATA expanded, it also gained increasing national recognition. Starting in 1991, the Alliance established an Honorary Board of Directors, on which prominent disability activists and people with disabilities were given membership. Early honorary members included: Stephen Hawking, Sandra Parrino (the director of the National Council on Disabilities), Johnny Wilder (a quadriplegic jazz musician), Max Schliefer (editor of the *Exceptional Parent*), and Judy Heumann.[478] Along with Heumann's previous work with Jackie Brand, both Wilder and Schliefer also had close personal ties to the ATA. Wilder had connections with Alan Brightman and Apple Computer. Brightman often relates a story in interviews of the keynote address at a American Occupational Therapy Association conference where Wilder demonstrated his ability to write music on a Macintosh computer using a sip and puff straw switch.[479] Brightman employed this anecdote as an example of how rehabilitation professionals needed to be convinced of the power of the personal computer in providing access to activities many people believed impossible for individuals with disabilities.[480] Schliefer's *Exceptional Parent* magazine for parents of children with disabilities was a regular publisher of articles on the DCCG and ATA. The following year, Christopher Burke, a well-known actor with Down Syndrome famous for his role on the television series, *Life Goes On*, joined the ATA's honorary board.[481]

The ATA, however, was not capable of unlimited growth. There were limitations built into the framework of its network structure that kept the Alliance stabilized at

---

[478] Glass, "Partners in the Promise of Technology," 81.
[479] A sip and puff straw is single switch adaptive device which allows the user to control a computer by blowing into a straw to make selections.
[480] Brightman, "Assistive Technology Oral History Project."
[481] Glass, "Partners in the Promise of Technology," 83.

around 40 resource centers. Being composed of a network of independent, local centers, the ATA was dependent on the ability of these centers to maintain themselves. These small, local centers were frequently dependent on the motivation and dedication of the individuals—often their founders—who ran them; without these individuals or someone to replace them when needed, centers sometimes ran out of steam and collapsed.[482] While the ATA had strong successes and steady growth during the first five years after its founding, there were also failures; six resource centers lost Alliance membership during this time. Of those six, one was shut down suddenly by its own umbrella organization, two closed after the people running them left and no one else took over, and three were removed from the Alliance after they failed to meet minimum standards of operation and would not improve after the ATA attempted to help.[483] In response, the ATA developed a list of potential indicators that a center might be falling apart, so that they could step in with plenty of warning to provide assistance. According to Bob Glass, these indicators included: "Little or no presence on AppleLink; difficulties between the center and a sponsoring, dominant umbrella organization; strong dependence on single individual or couple who leave the center or community; failure to return the annual Program Impact questionnaire; and failure to send at least one representative to a national training event."[484] When at least two of these conditions were met, the ATA would offer assistance to the struggling resource center. Even with these attempts to save failing centers in place, the ATA still was unable to grow beyond the numbers it was at in the early 1990s; the

482 Such a tendency was seen with a far larger group, ACM SIGCAPH, which I discussed in chapter 2. Throughout its first two decades, SIGCAPH experienced waves of success and energy, followed by periods of low productively when volunteers to organize and produce for the group could not be found.

483 Ibid., 93-94.

484 Ibid., 79.

Alliance appears capable of working with that many resource centers, across that much of country, and no more.

5.5 The ATA and IBM Partnership

While the ATA may have been limited in how far it could grow with its local, resource centers, the Alliance did move on to bigger projects by combining its efforts with those of other corporations than just Apple Computer. The ATA was not on its own in maintaining its projects and resource centers; corporate involvement and donations continued after Apple Computer formally disconnected itself from the Alliance.[485] In late 1990/early 1991, IBM stepped in and replaced Apple as the new major corporate sponsor of the ATA.[486] IBM's partnership with the ATA took a different form than Apple's, mainly being less closely intertwined, though just as generous in terms of donations.

One consequence of being a global company, with offices spread out geographically, was that IBM worked with numerous disability organizations that were nationally focused or with widespread local branches, as opposed to Apple's partnership with groups that they encountered locally. IBM's work with the Easter Seals to provide computers at a discount to people with disabilities, which was discussed in chapter 4, is one example. During the 1990s, the National Federation of the Blind maintained a particularly warm relationship with Jim Thatcher, the IBM researcher who worked on the developed of IBM's Screen Reader. Curtis Chong, the President of the NFB in Computer

---

[485] Though during the 1990s Apple would cease to provide support for the ATA in any way, they did return to the Alliance briefly in the early 1990s to once again fund the AppleLink network connection between resource centers. Ibid., 81.

[486] Ibid., 78.

Science, applauded Thatcher's work on the Screen Reader and his willingness to present at NFB annual meetings whenever he was invited.[487] The NFB presented IBM with a letter of support, in 1993, for its development of the Screen Reader/2 for OS/2 and its graphical interface.[488] Other organizations that IBM partnered with through their local branches across the country were the Easter Seals, the United Cerebral Palsy Association, and the Alliance for Technology Access.

In the early 1990s, IBM partnered with the Alliance for Technology Access as one of their major corporate supporters. There were two aspects to their relationship; IBM both provided technological resources to Alliance disability and technology resource centers across the country and participated in large-scale projects with the ATA. IBM began appearing as major contributor to the ATA in their annual reports during this time. The ATA described their appreciation for IBM's generosity, "IBM merits immense respect in the field of assistive technology, and FTA is both pleased and proud to be partners with IBM in the promise of technology."[489] In 1991, IBM began a long-term loan of $250,000 worth of software, adaptive devices, and technical support to ATA resource centers. The ATA centers worked alongside IBM's National Support Center for Persons with Disabilities to implement IBM computers with Independence Series products (at this time, Screen Reader, SpeechViewer, and PhoneCommunicator) at the centers. IBM also provided a suite of educational software in reading, language, math, sciences, and typing.[490]

---

[487] Chong, "Correspondence on the GUI Problem."
[488] Ibid.
[489] ATA Perspectives v. 2, 3. The FTA was the Foundation for Technology Access, the original name of the non-profit organization that ran the Alliance. The FTA name was dropped in 1994, and the entire organization has been referred to as the ATA since.
[490] Ibid., 3.

IBM also played a part in a national project with the ATA and Mattel that worked on spreading computer knowledge to children and to treat children as intended computer users; as a part of this project, children with disabilities were also explicitly acknowledged as computer users. In 1991, IBM joined with the Mattel Foundation—the toy company's non-profit, charitable, offshoot organization that helps children in need—and the Alliance for Technology Access in the Computer Learning Lab Project (renamed, in the late 1990s, to the Mattel Family Learning Program). The project was started by the Mattel Foundation, in 1990, to install computer labs with IBM equipment in schools across the country for use by students in kindergarten and first grade. A 1991 article in the Cherokee Country Herald described the project and one of the labs that was being set up in a local school.[491] By 1991, Computer Learning Labs were in place in 30 schools, with 1500 students using the labs. The labs used IBM's Writing to Read software, a phonemic spelling system that allowed children to write any word they knew, before they were old enough to learn proper spelling and grammar. Mattel favored the Writing to Read program over other, similar programs, because of its consistency in how it taught the user. The personal computer, as a universal tool that allows for new forms of learning and communicating, offered possibilities as a tool to teach reading and writing in ways that improved upon traditional educational tools and methods. In addition, each computer station in the labs also used four other pieces of software: Kidware by Mobius, which allowed younger students to prepare for Writing to Read; Talking Textwriter by Scholastic, a simple word processor that provided voice feedback; and, from IBM,

---

491 "CES to get Computer Learning Lab," *Cherokee County Herald*, Oct 23, 1991, 6A, accessed August 29, 2012. http://news.google.com/newspapers?id=T88vAAAAIBAJ&sjid=Xj4DAAAAIBAJ&pg=6859%2C1561202.

SpeechViewer to help students with speech disabilities and a Spanish-language program for students who were bilingual.[492]

In order to make the Computer Learning Labs explicitly incorporate the needs of all children using the computer—including children with disabilities—Mattel needed the expertise of disability and technology activists. The ATA joined the project in order to expand its scope to improve access to computer tools in the classroom for children with disabilities, particularly for children with multiple disabilities.[493] Local ATA resource centers connected with schools hosting Learning Labs and provided training and support for the teachers, children, and their parents. The ATA's role took place in two phases. First, they developed training programs to teach educators and parents how to use the computer technologies, particularly the adaptive devices and accessibility features needed by children with disabilities. In 1992, the ATA organized a national meeting for educators, parents, and ATA staff involved with the labs to enhance training.[494] The Alliance was also involved in working directly with the Writing to Read software to better allow its use by children with disabilities. They described their efforts to combine Writing to Read with necessary accessible technologies: "Utilizing IBM computers and a range of assistive technology products, the school will more fully integrate students will disabilities into IBM's Writing to Read curriculum in order to enhance the learning

---

492 Ibid.

493 Some articles on the Mattel Family Learning Program from the late 1990s state that the ATA did not join until 1994. This appears to have been a numerical error that was perpetuated. In a conference presentation, published in the *Proceedings of the Technology and Persons with Disabilities Conference 1999*, members of the project from the ATA and Mattel included the following aside after the incorrect 1994 date, "[didn't our relationship with them begin prior to this?]." Holland et al., "The Mattel Family Learning Program - An Innovative Community Partnership," *Proceedings of the Technology And Persons With Disabilities Conference*, 1999. http://www.csun.edu/cod/conf/1999/proceedings/session0100.htm.

494 ATA Perspectives v. 2, 6.

experience of all students."[495] In the second phase of the ATA's involvement, they helped organize online functions for the labs, providing further training, technical support, and a web site for the project.[496]

By 1999, the Computer Learning Labs had involved 4150 children with disabilities. IBM does not appear to have stayed involved with the Computer Learning Lab project for long after the ATA joined. Both Mattel and the ATA expanded the program to not only use IBM's Writing to Read, but to allow schools to choose the technology that would work best for their individual programs. In one example, in a lab installed in 1998 at California State University Northridge's Child Development and Family Relations Lab School, Apple Power Macintosh computers were used, instead of IBM or IBM-compatible ones.[497] The Computer Learning Lab Project, over the course of the 1990s, succeeded at not only bringing computers into schools for children to learn how to use, but also demonstrated some of the potential the computer had as a new kind of tool that provided ways to learn skills such as reading and writing. The project also explicitly included children with disabilities as both students in the classroom and as computer users, enacting also the potential of the computer as a universal technology, usable by and beneficial to everyone.

IBM's work on projects like the Computer Learning Lab and its partnership with the ATA demonstrates some of the diverse ways that major computer companies did work with and for people with disabilities during the 1980s and 1990s. The development of

---

495 ATA Perspectives v. 2, 5.

496 Holland et al., " The Mattel Family Learning Program,"

497 Kim Burruss, *CSUN's Child LAB Receives Gift of New Computers,* California State University Northridge, Press Release, Sept 22 1998. http://www.csun.edu/~hfoao102/press_releases/fall98/lab.html.

accessible personal computer technologies and interactions with disability and technology activist organizations from IBM and Apple reflected the different values and histories of large-scale, general computer companies. IBM methods of working with people with disabilities was very internally organized—multiple accessibility features were created to benefit IBM's own employees, IBM employees with disabilities created technologies and projects that might aid themselves and other people with disabilities, and programs were established to train people with disabilities in computer-related careers. Much of the impetus to focus corporate attention on the accessibility of personal computers during the 1980s by IBM and Apple came about, in large part, from a single non-disabled employee. Both Jim Thatcher and Alan Brightman were interested in computer technologies that could benefit people with disabilities and worked within their corporate environments to bring attention to accessibility needs. Similar to Brightman's founding of Apple's Office of Special Education and Rehabilitation, Thatcher's work creating the IBM Screen Reader and the positive reaction to it from the blind community led to the formation of IBM's Independence Series of products for people with disabilities and its organizational division of accessibility work between the National Support Center, Special Needs Programs, and Special Needs Systems.

Unlike Apple, IBM was more publicly focused on its disability endeavors. IBM's longer history and strong public opinions, both positive and negative, may have led to a greater need for the company to promote its accessibility work, to influence public opinion during and after the Justice Department lawsuit. IBM touted its diverse hiring practices and training programs for people with disabilities before the advent of the personal computer. During the 1990s, when both Apple and IBM experienced near catastrophic losses, Apple chose to discontinue their internal accessibility group in a cost-saving move; IBM, however, kept its accessibility groups and efforts to develop accessibility features going during its downturn. Finally, IBM avoided much of the public criticism over lack of accessibility for the graphical user interface that was faced by both Apple and Microsoft during the late 1980s and early 1990s. IBM developed its own in-house screen reading technology, instead of relying on third-party developers and the need to provide them with documentation and access to the operating system. IBM's Screen Reader/2 was the only screen reader option for OS/2—an operating system whose success was short-lived—but IBM's quick work in developing the software resulted in praise for the company from the National Federation of the Blind, at the same time they were harshly criticizing Microsoft. IBM's fundamental values did not include the user-friendliness, design aesthetic, or utopian possibilities of computer technology that lay at Apple's core; instead IBM followed goals of diversity and market domination within a large, complex corporate structure that allowed for small, personal projects to thrive and become consumer products.

As the children who experienced the benefits of 1970's civil rights legislation grew up and became adults, they propelled the disability rights movement forward with a new sense of common identity as people with disabilities. Protests at Gallaudet University garnered national attention and growing momentum behind stronger civil rights protections for people with disabilities. The passage of the Tech Act and Americans with Disabilities Act, within two years of each other, provided better, more enforceable anti-discrimination protection for people with disabilities; in order for the civil rights they guaranteed to come to fruition, technological accommodations were necessary to enable people with disabilities to fully participate in society. The Alliance for Technology Access took part in fighting for the passage of these laws and, after their passage, in utilizing the resources the legislation provided in developing larger, more inclusive projects across the country to connect people with technology. These accomplishments of disability rights would pay off in the 1990s with greater national awareness of the need for accessibility, as well as the increasing involvement of major computer companies in disability and technology activism. IBM, in particular, stepped into Apple's former shoes as the main supporter of the ATA, providing resources to the Alliance and taking part in projects with them. As computer technology improved, however, it would also create new barriers for people with disabilities that would need to be overcome. In the next chapter I discuss how the personal computer underwent a technological paradigm shift that was both dreaded and eagerly anticipated by people with disabilities and which would have to be accommodated in order for the personal computer to be usable by everyone.

Chapter 6

Accessibility and Software Applications in the 1990s

Once accessible input and output technology—such as adaptive devices, speech to text hardware and software, or screen readers—allowed people with disabilities to have access to a personal computer, they then needed to use software applications on the machine. Physical access to the computer had to be achieved first, before anything could be accomplished with it. In the 1990s, software and operating systems became the main focus for disability advocates. For the most part, this meant the same software everyone else used: word processors, spreadsheets, graphics programs, games, e-mail, and internet browsers. While different people might use a different kind of input device to control a computer that worked specifically for their abilities, they would likely then all want to use the same software application. Ideals of designing buildings and technology to work for all users coalesced into the concept of universal design, culminating in 1997 with the *Principles of Universal Design,* which I discussed in the Introduction. The development of accessible software from the 1980s through the 1990s reflected the computer industry's acceptance of values of what would become universal design.

Many of the accessibility features built into operating systems in the 1980s worked with different software applications, to allow people with disabilities to control their software in the ways they needed. These included features such as screen enlargement or zooming, disable repeat keys, and disable multi-key presses. These built-in features did not work with all software equally well, however. The values behind universal design—increasingly taken up by technology developers—provided a solution to the problem of making software work for all users. Certain third-party software vendors addressed issues of accessibility by developing their applications with these ideals in mind, to provide ways for accessible technologies to work with general ones and maximize the number of users who could use their technology.

Instantiating the values of what would become universal design into the development process was one way for companies to increase their user base in the skyrocketing personal computer software industry. By the mid-1990s, the U.S. software industry brought in more than half a billion dollars annually, and climbing each year, with Microsoft controlling around half of the market share.[498] The internet was also growing and becoming more commonly used at this time, changing the meaning of software, as more people conducted more of their personal business on websites. Personal computer technology also began to stabilize during this time, as Microsoft Windows became the dominant operating system and what had previously been radical innovations became standardized. I explore different ways that software developers dealt with accessibility—both from within operating systems and in third-party applications—as personal computer technology grew to encompass more aspects of everyday life. I also examine the role activist groups continued to play in demanding access to personal computers for people with disabilities. By the end of the 1990s, personal computer accessibility had

---

[498] Martin Campbell-Kelly, *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry* (Cambridge, MA: MIT Press, 2003), 15-16 and 234.

become less the work of small companies and individuals, and more normalized as technological features allowed more people to use computers the way they needed to.

I begin this chapter by discussing large changes that took place in personal computer technology during this time; specifically, I analyze the paradigm shift in computer operating systems that resulted in a switch from a text-based to a graphical user interface. This was a significant change to how people used computers that took around a decade to cement itself in the technology. The graphical user interface was anticipated either positively and negatively by people with different kinds of disabilities and their advocates. I show the different perspectives on how this technological shift was anticipated and the ways its negative aspects were dealt with. I delve into the accessibility work done by one major software company, Brøderbund Software, and its partnership with the Alliance for Technology Access, in the late 1990s. I then shift gears to discuss the work done by both the Alliance and the Disabled Children's Computer Group in the mid-1990s, as the organizations grew and changed, taking on projects involving software and the burgeoning internet. Finally, I conclude my history of the development of personal computer accessibility in the late 1990s, as the ATA underwent a change in leadership and Apple Computer's Worldwide Disability Solutions (formerly the Office of Special Education and Rehabilitation) was dissolved. I discuss the state of accessibility at the turn of the century, as certain battles had clearly been won, but others were continually emerging to challenge the accessibility of personal computers for people with disabilities.

6.1 From Text to the GUI

Perhaps the final, major paradigm shift in personal computer technology to directly affect the users' experience was the gradual domination of the graphical user interface (GUI) over the text-based (or command-line) user interface.[499] This was a technological change that altered all users' interactions with the personal computer and had particular salience for users with certain kinds of disabilities as their needs were either accommodated more fully with this new technology or ignored. This innovation led to, for the most part, personal computers being more user-friendly, but, as with any change in the usability of a technology, certain assumptions were built in regarding who would use it and how. People with certain kinds of bodies found GUIs an improvement, while others—particularly those with vision impairments—experienced a new obstacle in interacting with the computer. This was also a shift that did not occur quickly; though invented during the 1970s, the GUI was not available on a commercial personal computer until 1984 and was not the ubiquitous interface until the mid 1990s. This gradual switch allowed computer users to anticipate—both positively and negatively—the change from text to graphics. Proponents of personal computer accessibility criticized the development of the GUI for users whose needs they feared would not be met. The GUI functions here as a technological change that created greater usability and access for most computer users, but put up barriers for people with certain kinds of disabilities. Because this was a gradual technological shift, the obstacles it created were anxiously anticipated far in advance of the GUI's eventual dominance. However, this long span of time also allowed

[499] The computer interface can be thought of as the way the operating system and software applications allow the user to interact with the computer: i.e. the keyboard commands or mouse controls that the user operates the control the computer, as well as what is displayed on the computer screen that the user sees.

technological solutions to these problems to be found and put into place, to some extent, as the technology developed.

Until the mid-1980s, personal computers used text-based interfaces only, such as Apple Computer's DOS[500] or Microsoft's MS-DOS. These operating systems required the user to enter commands in the form of text via the keyboard in order to operate the computer. The computer screen displayed output for the user in the form of characters on lines.[501] Graphics became possible as text-based interfaces developed, but programs had to enter a special graphics mode to display them and they were limited in terms of realism and detail. Even text on these computers could not be displayed to look as it would print, as the computer screen could only display characters at a set size and shape. The reason behind such limitations was in the way text-based operating systems efficiently used the scarce computer memory resources available in early personal computers. A display buffer in the computer's memory stored the information that the computer would output on the display in the form of ASCII codes for each character indicating its content and properties, such as bold, underline, or color. As only those characters which needed to be displayed were stored in memory, it was far less resource-intensive to only light up those characters being used at any given time; hence the iconic image of early personal computers of bright green text on a black screen.[502]

Software interfaces were not standardized in text-based operating systems; the

[500] Disk Operating System.

[501] To simplify, the ASCII standard determined how these characters were stored in the computer's memory and would look on screen. Two numbers contained the information for each characters—which character it was in ASCII code and whether it should display additional properties, such as color, bold, underline, etc.

[502] The computer memory would only have to store the information for those characters being displayed, thus using far less memory than if the background were lit up and the characters were displayed in dark text.

controls for one program may look nothing like the controls for another. A 1990 report from the TRACE Center at the University of Wisconsin, Madison explained how a user's experience was affected by early text-based interfaces:[503]

> With early traditional interfaces, one had no choice but to learn the keyboard commands and procedures for each application used. Commands and file names were typically typed again and again each time they were run or opened. Often, interaction with the machine required a tedious dialog of prompts and typed verbal commands.[504]

Though not all text-based interfaces were equally difficult to use, software developers were not required to follow standardized rules, and, as text-based interfaces were simple to write, programmers tended to create their own custom interfaces for each application.[505] On the whole, text-based interfaces were simple to write software for and efficiently used the computer resources available, but could be complicated for users to learn and operate, and also lacked standards and high resolution graphics.

The graphical user interface would fundamentally change both how the computer was controlled and how output was displayed for the user. Though the GUI was developed at Xerox's Palo Alto Research Center (PARC) during the 1970s, it was not available as a consumer technology until Apple released first the Lisa and then the Macintosh in 1984. Apple's operating system, System, used a GUI that today looks familiar; using a desktop or office metaphor, standardized windows, icons, and cursors, the user selects and clicks on graphical representations of operating system commands to navigate and control the computer. The GUI displays output on the computer screen

---

503 Lawrence H. Boyd, Wesley L. Boyd, and Gregg C. Vanderheiden, "The Graphical User Interface Crisis: Danger and Opportunity," TRACE Center, September, 1990, http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED333687.

504 Ibid., 4.

505 Ibid., 5.

through bitmapping; the screen is divided into pixels and output information is translated into groups of pixels that are lightened or darkened. Memory for all pixels are always stored in memory. While this was more resource-intensive, it allowed for dark text on a light background at no greater cost than light text on a dark background, as well as far greater possibilities for detailed graphics and text that looked the same as it would when printed.[506] With a GUI, the operating system also enforced standardized interfaces for the first time. Each program would run within similar looking windows, with similar menus across programs.[507] Software programmers had to follow rules set by the operating system manufacturer in order to utilize operating system tools. Though the GUI would not become the dominant personal computer interface technology until Windows became both stable and popular in the business world with the release of Windows 3.1 in 1991, the GUI was anticipated as the inevitable future standard from the mid-1980s on.

For most computer users, the GUI was a vast improvement in terms of usability and functionality over text-based systems. Concurrently running programs (software multitasking), standard menus, detailed graphics, and intuitive computer control via the mouse and desktop metaphor made computers more user-friendly. The idea behind an interface like the GUI comes out of values held by early computer developers that the computer had the potential to be both a convivial technology and a technology of intellectual augmentation. Its development at Xerox PARC by computer researchers such as Alan Kay was motivated by desires to make the computer usable for everyone. In his history of the Macintosh, journalist Steven Levy describes Kay's desire to create a

[506] Instead of storing display information in a text buffer that translates characters into ASCII codes, both characters and graphics displayed on a GUI consist of shapes made up of darkened (or lightened) pixels. Ibid., 3.

[507] Ibid., 5.

computer interface that could be used by a child and would be intuitive to even completely new users, "Whereas previous systems—from the punched cards and batch processing systems of IBM to the dense code words of UNIX—tacked on an interface as an afterthought, Kay understood that future systems would have to be built around a genial software physiognomy." In order to realize its potential to augment human ability and improve human lives the part of the technology that the user interacted with—its face, so to speak—had to be made into something users would both want to and be able to use. Levy quotes Kay on the central role of the interface here: "What is presented to one's senses *is* one's computer" and explains that at PARC this was referred to as the "user illusion."[508] The computer interface is the computer for the average user; it is how they control and navigate the computer and how they experience the information that is outputted. Most users never go behind the scenes to program code; even much of the computer's hardware is black-boxed and hidden. The interface is what the user interacts with, and with the GUI and its metaphor of the desktop, the user is further removed from the computer architecture itself and experiences the computer as something familiar and commonplace. This familiarity through identification with a metaphor distances the user from the technology itself; as the technology is black-boxed behind the desktop (both physically and on the screen), the user experiences it in a way that gives them less access to what is actually going on within the computer and its code, but at the benefit of increased usability.

The benefits of the GUI as intuitive and recognizable to operate held true for most users with disabilities as well. GUI systems were designed with standardized menus and

[508] Levy, *Insanely Great,* 58.

the same commands in the same location that were common across programs, which made learning how to use the computer easier for everyone. IBM researcher James Thatcher described, in the *Braille Monitor*, how this move toward standardization at IBM would work for different users in 1994:

> Basically one uses the same ways of navigating in many different applications. Text-mode programs were heading that way as they added menu bars, pull-down menus, dialogs, and the like. Still navigation in text-mode Word-Perfect 5.1, Lotus 1-2-3, and Quicken were all different. The GUI versions (OS/2 and Windows) of these applications do in fact have a common interface. The ways to get to menus, to move around menus, to pull down menus, to interact with dialogs are all the same.[509]

The standardization in GUI software controls made learning how to use the personal computer easier for everyone. In particular, the increased ease of use helped people with learning disabilities who had struggled with text-based computers. For people with disabilities that required them to use adaptive devices to control the computer, standardization provided program controls that adaptive device manufacturers could expect to be the same regardless of the software being used. Being able to anticipate standard menus and controls made it easier for adaptive devices to work with different programs, by allowing assumptions to be made about how software operated, even with programs the device or user had never encountered before. This standardization allowed for different ways of using the computer for people with different bodies; people could accommodate their individual needs and then utilize the same computer programs as everyone else.

The GUI was a particular benefit for those users with disabilities that made

---

[509] James Thatcher, "Problems and Challenges of the Graphical User Interface," *The Braille Monitor* 37, no. 1, January, 1994, http://nfb.org/legacy/bm/bm94/brlm9401.htm.

graphics more usable for them than text, such as those with certain learning disabilities or those who found it easier to operate a mouse to point and click than typing on a keyboard. In order to understand the user's perspective on why the GUI could be such an improvement in personal computer technology, I examine the account of Mike Matvy, a psychologist with learning disabilities affecting his reading and writing, who provided a detailed report on his experiences with personal computers to the Alliance for Technology Access, for their technology and disability symposium in August, 1990.[510] After acquiring a job where he no longer had secretarial support that allowed him to dictate written materials that someone else would type up, Matvy approached an ATA resource center to learn how to use a computer that would read aloud printed materials and help him take notes and organize records. He learned how to use both an IBM computer with MS-DOS and an Apple Macintosh. Matvy had difficulties with the IBM computer's text-based interface, which required typing commands to operate, whereas the Macintosh was easier with its graphical representations. He describes the problems he had with MS-DOS as, "When I started on the IBM I found that reading and spelling was required every step of the way. As soon as I turned it on I have to start sounding out words and gessing at spelling."[511] and "It seam odd to me also that I can learn how MS-DOS works and how to use it to talor specific setts of commands (macros) to do clever things, yet I can not remember the simple letters and sintax required to put MS-DOS to use."[512] It was the interface's reliance on text, which continuously needed to be read and entered in order to

[510] Planning documents. "Impact!: Working Documents," Spring, 1991, box 2, folder 3, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, Section 5.3.

[511] Ibid., Section 5.3.1.3. I have copied Matvy's original text with his spelling. I have, however, added spaces in between words that were not originally present, in order to improve the readability of his quotes.

[512] Ibid., Section 5.3.1.1.

operate the DOS computer which acted as a barrier, blocking Matvy from full access to the personal computer.[513] As long as it used a text-based interface, the personal computer would remain an inaccessible technology for him.

The Macintosh, however, utilized a GUI with symbolic, graphical representations, such as desktop icons. Matvy learned how to use the Macintosh quickly and even found that the text present in the Macintosh's menus was easy for him to memorize, since it was standardized across applications. He described his success using the Macintosh:

> I could also see why I was able to move through the MAC system with such speed and eaze. It is built on a visual system, but it requires no spelling and verry little reading to oparate it. The fue writen words in the pull down minues and the dialog boxes are repeated identicly in all aplications. They are also kept with in a pictoral context which helps me know what the words are.

For someone with learning disabilities related to visual text, the Macintosh's GUI provided a more user-friendly and intuitive experience. The interface itself functioned here as an accessible technology, allowing people to operate personal computers in ways that worked with their abilities. Whereas the GUI was an improvement and convenience for most users, for Matvy it was a necessity.

Though the positive aspects of GUI technology were eagerly anticipated for people with certain kinds of disabilities, blind and vision impaired users looked to the future of the GUI with trepidation. Built into the concept of the graphical interface was the assumption that users could see the screen in order to control the graphical environment. This was a mass market, general technology created for a sighted user. In order to accommodate the needs of people with vision impairments, third-party assistive

---

[513] Matvy also mentions testing a version of Windows on an IBM computer, likely Windows 2. He encountered similar problems with this version of Windows as with MS-DOS, in that both required reading text to navigate the computer, even in the menus of the Windows system.

technologies had to change the way the computer output was experienced; namely, by using screen reading software, vision impaired users could hear the displayed information.[514] Blind users' worries about the GUI had to do with the way screen reading technology of the 1980s functioned and its perceived limitations. As explained by James Thatcher, of IBM Research (IBM's global network of science and technology research labs), screen readers already had problems when they encountered graphics in a text-based operating system; screen readers were unable to translate the graphics into useful information, so they would skip over graphical modes of software or be blocked entirely from certain applications.[515]

Problems translating the graphics of a GUI were not the only worry, however; doubts also existed about the capability of screen readers to understand the way that even text is displayed on a GUI, with its use of pixels instead of ASCII characters. With a text-based interface, a screen reader would access the display memory and translate the ASCII codes stored there into spoken words. With a GUI, however, the display memory only contains information on the status of each pixel, without any information on the content of what is being displayed.[516] Screen readers needed a way to work with this output information differently than how they had operated previously. In July, 1989, Herb Brody described the reliance on text-based systems for screen-readers in an article in PC/Computing magazine: "In fact, virtually all PC adaptive equipment for the blind

---

514 People with certain learning disabilities affecting their ability to understand metaphors also struggled with the GUI's use of a desktop metaphor. They, too, would need to use screen reading technology as a way to translate the symbolic, graphical representations of icons into labels that described literally what actions the computer would take when something was clicked on.

515 For example, up until the early 1990s, blind users were unable to access Flight Simulator entirely, as well as features in WordPerfect and Lotus 1-2-3 when those programs entered a graphics mode. Thatcher, "Problems and Challenges of the Graphical User Interface."

516 Ibid.

operates in the character-based DOS environment."[517] Any graphics the screen-reader encountered on an IBM-compatible computer would be ignored. With a Macintosh, however, screen-readers were, at this time, unable to translate the pixels on the display into text. Brody describes the fears being felt about how the coming change from text to GUIs would affect blind users: "The day is approaching when graphics cannot be ignored. The PC industry's move to graphical user interfaces is arousing concern among the visually disabled—and with good reason.... The more graphical the interface, the less translatable it is into speech." Brody's predictions of the coming importance of graphics in computing were correct, as were his worries that the screen reading technology he knew would be unable to handle graphical interfaces. The solution for blind computer users would eventually be a technological one, accomplished during the slow transition from text to graphics.

By the early 1990s, users looking at personal computers with either text-based interfaces or GUIs could still select whatever worked best for them individually, as a number of options existed. While Windows 3.1—released in 1992—was becoming the dominant personal computer operating system, MS-DOS was still being developed and sold. Windows ran on top of MS-DOS, which allowed DOS applications to continue to be run on a Windows computer—including programs and devices for people with disabilities, such as screen readers. For blind computer users, fears of never being able to access GUI computers finally proved false; the first screen reader that worked with a GUI, OutSpoken from Berkeley Systems, was released in late 1989 and ran on the Macintosh. IBM's Screen Reader/2, which I discussed in chapter 4, was released for its

[517] Brody. "The Great Equalizer," 84.

OS/2 GUI operating system in 1991. Though it was an important technology for blind users, as one of the first GUI screen readers and developed in communication with both blind IBM employees and the National Federation of the Blind, it would never reach a large market, as the OS/2 operating system never captured a mass consumer base and a few years later Windows came to dominate the personal computer market. The first screen reader for Windows, SlimWare Window Bridge from Syntha-Voice Computers, was released in 1992 for Windows 3.1. A few years later, Syntha-Voice would also release the first screen reader for Windows 95.

The solution to the problem of how to enable screen readers to translate information on a GUI system came from rethinking how the screen reader accessed information. In order for a screen reader to translate GUI information into text, Berkeley Systems developed what they called the Off-Screen Model for their OutSpoken screen reader. Instead of using the information contained in display memory, which had worked for text-based interfaces, the Off-Screen Model allowed information to be intercepted before it went to the display and stored separately in memory for the screen reader to access. As opposed to reading what was being displayed on the screen after the fact—and thus being unable to translate pixels into text—the screen reader would now use this separate memory created by the Off-Screen Model to read what was being sent to the display in the first place, before it was turned into pixels.[518] This innovation allowed screen readers to function on a GUI for the first time, and though other obstacles relating to the shift from text to graphics remained, blind computer users were no longer faced with what had seemed an insurmountable barrier to the new computer interface.

---

[518] Thatcher, "Problems and Challenges of the Graphical User Interface."

The OutSpoken screen reader not only offered a way to translate GUI text to speech, but it also provided some access to control of the Macintosh operating system that a sighted user would have, as a way to preserve the spatial layout and navigation that a GUI offers. OutSpoken translated names of icons and simple graphics.[519] In order to translate graphics, the screen reader needs access to information containing some sort of label of the graphic's content. This could involve the name of an icon or a non-visible label that the operating system or software makes available. To navigate the computer, the computer cursor was controlled with the number pad on the keyboard, instead of with a mouse.[520] The user could press a function key and OutSpoken would speak the location of the cursor on the screen and indicate when the user reached the edge of the screen.[521] However, this first GUI screen reader was not perfectly integrated into the Macintosh operating system; it did not work with all software applications, did not offer the option to use the mouse, could not translate complicated graphics, could not be adapted to any specialized needs of the user, or work with other operating systems. The TRACE Center, at the University of Wisconsin-Madison, praised OutSpoken for being the only screen reader at the time to work with a GUI system, but criticized it for not providing vision impaired users with the full benefits of the GUI, as it only used speech to communicate information to the user.[522] The TRACE Center hoped for technology to take further advantage of what the GUI offered by utilizing other sensory information, such as tactile output or locational sounds, to allow the vision impaired user to navigate the computer

[519] Boyd et al., "The Graphical User Interface Crisis," 8.
[520] This keyboard control feature would also benefit people who worked on highly detailed graphics, as the cursor could be more finely controlled via the keyboard than with the mouse—an example of an accessibility feature that increases usability in other cases as well.
[521] Ibid., 9.
[522] Ibid., 10.

using representational output in the same way a sighted user used representational graphics.[523] Though such alternative sensory technologies were technically possible, their development has been met with limited success and screen readers remain the dominant accessibility technology for people with vision impairments.

For a few years during the early 1990s, these multiple options of types of computers and interfaces existed for people with disabilities to figure what best fit their own individual capabilities. A 1993 booklet published by the Disabled Children's Computer Group on "Access to Computer-based Telecommunications for People with Disabilities" included recommendations for users choosing between IBM-compatible computers with DOS, IBM-compatible computers with Windows, or Apple's Macintosh computers.[524] In terms of control of input and navigation for the user, the DCCG suggested either type of interface depending on the specific disability of the individual:

> For people whose physical disability precludes use of a mouse or trackball, a DOS system might be preferred because it does not require either one. For those that cannot use a keyboard of any kind, text can be entered by speaking, by using an alphabet scanning/switch system, or by entering data directly through a switch (for example, by using morse code). ... The control of an on-screen cursor by means of a switch is possible, but cumbersome, usually requiring the user to enter a series of directional commands. However, people who are unable to enter text from a keyboard, but are able to use a cursor with a mouse, joystick, or trackball, may prefer a Macintosh or a Windows interface, which can be faster and simpler to use.[525]

The DCCG's advice here is similar to the advice they had been offering since the early 1980s: people with disabilities needed to find what worked best for them individually. No one personal computer was going to work for everyone, and different adaptive devices

[523] Ibid., 11-12.

[524] Booklet. Linda Wahl and Paul Hendrix. "Access to Computer-based Telecommunications for People with Disabilities," Disabled Children's Computer Group, 1993, box 1, folder 9, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 35.

[525] Ibid.

and software were available for different systems. For people with vision impairments, the DCCG still suggested they use a text-based system, though screen readers were beginning to be developed for GUIs at this time:

> Controlling an on-screen cursor requires the user to see the screen and the cursor; although there are screen enlargement programs that make this task easier, their inability to display the entire screen at once can make navigation difficult. Visually impaired persons using text-based systems can also use screen readers that read aloud the information displayed on the screen. There is a wide range of screen readers for DOS systems, and currently three choices that will read the graphics-based systems. Given the choice, a DOS system presents fewer hurdles for people with visual impairments.[526]

Accessible technology was beginning to catch up with the change in interfaces, but in terms of ease of use, during the early 1990s, a DOS or other text-based system would still work better with available screen readers than a GUI operating system.

By the mid 1990s, the GUI had become the dominant personal computer interface, though it still continued to have problems of accessibility for vision impaired users. Users addressed the problems directly with operating system manufacturers. In particular, a dialogue took place between Microsoft and organizations for people with vision impairments, concerning Microsoft's failure to respond to the need for fully functional screen readers for Windows. The first screen reader for Windows was not available until 1992 and was developed with little help from Microsoft. In 1994, the head of Microsoft's Accessibility and Disabilities Group, Greg Lowney, responded to these criticisms in a letter to the National Federation of the Blind, admitting Microsoft's culpability:

> In the past, Microsoft has turned out many software products without really considering their accessibility to people with disabilities.... Windows has probably done more than anything else to earn Microsoft the enmity of the blind community. Microsoft has been both hated and feared by many people because we were

[526] Ibid.

> promoting a graphical operating system without making sure that it could be used by people who are blind, and the results have been disastrous for many people.[527]

Though Microsoft had not built in adequate accessibility or easy ways for third-party developers to create assistive devices for Windows, Lowney argued that, in theory, Windows should eventually be more accessible than MS-DOS, because the standardization of a GUI should allow screen readers to work across all software applications. Microsoft's growing operating system monopoly would play a dual role for users with disabilities; it would aid the spread of standardization and its benefits, but also compound accessibility problems when they arose as users had fewer alternatives. To assist their stated goal of improving accessibility, Microsoft began to release documentation to third party developers and to respond to users' feedback about Windows.

A few years later, after the successful release of Windows 95, screen reading technology had improved to the point where it had nearly full access to the GUI operating system and popular software applications. A 1997 article in *Access Review*, by Kenneth Frasse, compared the capabilities of available screen readers with Windows 95 functions and control of popular software applications (Microsoft Word, Microsoft Excel, Internet Explorer, and Netscape Navigator).[528] The tests consisted of everyday tasks of multiple steps that users would want to perform for business, home management, and recreation purposes. These tasks included examples such as: installing the screen reader from DOS, navigating across the desktop, copying and creating shortcuts, setting date and time,

---

527 Greg Lowney, "Message from Microsoft," *Computer Science Update*. National Federation of the Blind, Summer 1994, accessed August 29, 2012, http://cd.textfiles.com/nfbfiles/nfbcs/CS9406.TXT.

528 Kenneth Frasse, "GUI Access: A Comparison of Screen-Readers (Part I)," *Access Review* II, no. 2 (1997). http://www.nyise.org/whatsnew/review.txt.

changing display appearance, copying files, formatting a floppy disk, opening files in Word or Excel and reading through them, running spellcheck, and navigating to common websites and reading their contents. The screen readers were rated on their ability to allow the user to fully complete the task, complete it with varying severity of problems, attempt the task but be unable to complete it, or lack the functionality to even start the task. Only one of the screen readers tested performed well; GW Micro's Window Eyes was successful at almost all tests, capable of navigating both the GUI operating system and the software applications. Window Eyes would continue to do so; it and its chief competitor, JAWS from Freedom Scientific, still dominate the Windows screen reader market today.

During the history of its development, the graphical user interface presented both new opportunities for users with certain abilities and challenges for others. The GUI created new forms of access to personal computers for some people, such as those with learning disabilities who previously had struggled with text-based interfaces. It also provided new capabilities of information organization and browsing through the use of symbolic, graphical representation that made personal computers more user-friendly and intuitive for most users. However, this intuitiveness for most users came from the GUI's use of visuals, and with it, the assumption that users could see the computer screen to use it. It created new barriers for users with visual impairments, and its gradual development allowed both worries to grow and innovative technological solutions to be found. By rethinking the way screen readers accessed output information, GUIs were made at least somewhat accessible. The standardization and operating system control that came with the GUI also made screen readers capable of, in theory, functioning across software applications by allowing expectations of consistent navigation and control. Full enjoyment of the advantages of the GUI, however, were blocked from blind users during much of the course of its development, mostly as a result of lack of attention from operating system developers. Problems of accessibility for screen readers would continue with the 1997 public accessibility disaster of Microsoft's Internet Explorer 4, which I discuss at the end of this chapter; even once GUIs were made to work with screen reader technology, individual software applications continued to cause problems by not following accessibility standards—in this case within the same company that was working at the same time to make their operating system more accessible. Not all major software companies have resisted making their applications accessible to people with disabilities or considered it an afterthought. Turning from operating systems and interfaces to specific software applications, I examine the work done by one successful software developer to improve its own accessibility through a partnership with the Alliance for Technology Access.

6.2 The Alliance for Technology Access and Brøderbund Software

Brøderbund Software was one of the longest lasting and most commercially successful software companies during the 1980s and 1990s; they also concerned themselves with issues of accessibility as a way to make their products work with as many users as possible.[529] In his history of the software industry,[530] Martin Campbell-

[529] Though its name is still in use today on some products published by Encore Software, Brøderbund was sold in 1998 to The Learning Company and its software titles split between different companies.
[530] Campbell-Kelly. *From Airline Reservations.*

Kelly discusses the quick growth and popularity of Brøderbund. Douglas Carlston, a lawyer turned software programmer, founded Brøderbund as a videogame producer and publisher in 1980; it quickly grew to become a dominant player in software publishing for computers and game consoles.[531]

Staying successful through the 1980s, Brøderbund's sales increased dramatically starting in the early 1990s as the invention of the CD-ROM allowed for the distribution of far larger and more complex games and other kinds of software. In 1992, Brøderbund released "Just Grandma and Me," the first in its interactive, animated, *Living Books* series and an international best-seller.[532] A year later, Brøderbund published *Myst,* the most popular video game ever sold.[533] Brøderbund's success allowed it to operate a creatively free environment for its programmers, allowing the company to push the boundaries of computer programming.[534] Brøderbund marketed to a mass consumer base, publishing software for entertainment, education, and home management. Yet it did not develop computers itself; Brøderbund had to fit its products onto systems created by other companies. As it sought to attract more customers and improve the usability of its technology, the company began to pay specific attention to the needs of computer users with disabilities.

At the time of its peak of commercial success, in 1995, Brøderbund turned its resources and innovative energies to accessibility for people with disabilities, starting a partnership with the Alliance for Technology Access and becoming a vendor member of

531 Ibid., 277 and 279.
532 Ibid., 292.
533 Glenn Rifkin, "Competing Through Innovation: The Case of Broderbund," *Strategy & Business,* no. 11 (1998): 48-50. By 1998, *Myst* had sold four million copies.
534 Ibid., 50.

the Alliance. The philosophy behind this partnership was to promote a universal design approach that would make software applications work for as many people as possible. The ATA provided a definition in 1996 of their understanding of what universal design should entail and what they encouraged software companies to implement: “1) that all products are robust and flexible out-of-the-box, with built-in access features; and 2) until off-the-shelf full access is a reality, that products work smoothly with third-party assistive technology such as touch screens, alternative keyboards, screen readers or voice input systems.”[535] Enacting principles of universal design would mark a move away from any notion of the universal human as the intended user; instead of generalizing all users into one who is designed for, universal design calls for a pluralization of imagined users, encompassing all individual needs. Universality is then achieved by accommodating all possible differences between people.

The Alliance observed software developers adopting ideals of universal design and sought to promote the trend. More software applications were becoming available that worked for more users and responded to individual needs by providing options for how the user needed or wanted to operate their programs. In their book, which I discuss shortly, the ATA laid out their view on the trend toward universal design:

> As the plea from the community of assistive technology users has gone out for universal access, companies have responded. The worlds of assistive and conventional technology are blending, and a new generation of products is emerging—products designed to be used by *all* people. A number of companies are aware of the need and are designing products with universal access in mind. One company in particular, Brøderbund Software, recognizes the need for designs that provide the greatest function for the greatest number of users.[536]

[535] Annual report. Russ Holland, Tom Morales, and Mary Lester. *Alliance for Technology Access 1996 Impact Survey & Report*, (San Rafael, CA: Alliance for Technology Access) box 1, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 7.

[536] The Alliance for Technology Access, *Computer Resources for People with Disabilities: A Guide to*

The ATA uses the phrase 'universal access' as a way of focusing specifically on including people with disabilities as intended users. As with universal design, however, nondisabled users are also implicitly included. The binary classification of disabled and nondisabled users is replaced by a set consisting of the variety of needs of all users. As accessibility features became more commonplace and standard in personal computer technologies, the need for specialized devices and software diminished. Though universal design could never function absolutely—there is no one input device that all people can use, for example—even small features of flexibility and options for the user built into computer technology made it more usable generally. By building a philosophy of universal design into the initial programming process and working to understand the diverse needs of their users, developers would have a larger audience for their products. Brøderbund recognized the benefits of using universal design and contacted the ATA to have its own products tested and evaluated for their accessibility.

The ATA suggested two different approaches to using universal design to make software accessible for people with disabilities: allow external hardware input devices to work with the software and provide internal flexible options for multi-sensory or expanded sensory output. With the former, software developers could ensure that their applications would work with assistive devices such as alternative input devices:

> Making software more accessible can mean making sure that programs will work with specifically designed products that enable individuals to interact with software by using alternatives to the standard keyboard, mouse or method of display. Some examples of these include products that read aloud text on the screen, that allow a user to control the cursor by moving their head or raising an eyebrow, and that let

---

Exploring Today's Assistive Technology (Alameda, CA: Hunter House Inc., 1994), 41.

someone enter text by clicking a switch or speaking directly to the computer.[537] This first, immediate step of accessibility is physical access to controlling the computer. Just as the 1984 White House task force on computer accessibility that I discussed in chapter 3 recommended, all computers needed some form of access points available so that users could plug in and use whatever devices they needed individually to operate the computer. Once the user had access to the computer itself and the ability to physically control it, software developers could then build alternative options into their programs which would give users flexibility in terms of how they could understand the program's output:

> Within the software design process, making software more accessible means ensuring options are built in that offer alternative ways to work with a program, such as text options to augment dialogue, the ability for any program to read aloud text on the screen and the ability to enlarge the standard size of print and graphics.[538]

Such flexibility in output options allows users to operate the same program in different ways that work best for them. One example of such an option was one of the first accessibility features that Alan Brightman and Apple's Office of Special Education and Rehabilitation were able to have Apple engineers build into the Macintosh—a visual error indication instead of only an auditory one. This understanding of different needs was missing with the transition from text interfaces to graphics; though developers sought to improve usability for everyone—a universal design goal—they built in sensory assumptions of how the technology would be used—missing options for users who could

---

537 Press release. Jacquelyn Brand, Bridgett Perry (ATA), Eric Winkler, Kyle Hart (Brøderbund Software). "Alliance for Technology Access and Brøderbund Software Join to Raise Awareness of Software Accessibility Needs: Brøderbund and Alliance Call on Software Industry to Design Products that Are Accessible to Customers with Disabilities," box 2, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 1.

538 Ibid., 2.

not see.

Giving the user such choices of how to receive computer output creates access for people with certain disabilities where previously there may have been an insurmountable barrier and also increases usability for all users; someone who could see the screen but whose eyes tired trying to read small text could have ways to enlarge what they were reading or someone using a computer in a quiet environment could turn off spoken dialogue and read subtitles instead. Brøderbund explicitly noted this advantage of universal design in creating products that improved usability for all users, in the announcement of their partnership with the ATA:

> “We have consistently found that designing software that's more accessible to those with disabilities also makes the software more intuitive and easy to use for the balance of the market,” said Bill McDonagh, President and Chief Operating Officer of Broderbund. “Besides being the right thing to do, it makes all of our products just a little better.”[539]

Focusing on universal design as a programming philosophy to be built into the programming process was hoped to both increase Brøderbund's customer base and improve the users' experiences with its products. By keeping in mind the diverse needs of users—including differences in sensory abilities and the use of adaptive devices—universal design attempts to prevent accessibility problems, such as those caused for users vision impairments by the development of the graphical user interface. Software companies could avoid building barriers in by understanding how their users accessed and controlled their computers. Changing their programming methodology was not the only way that Brøderbund sought to improve software accessibility, however.

The concept of access has multiple meanings and ways of accomplishing it;

---

[539] Ibid.

beyond building accessibility features into its products, Brøderbund also worked with the ATA to entrench the idea of accessibility into the computer industry. Their partnership sought to influence accessibility in other companies and to provide communication tools that would allow developers to better incorporate accessibility features. Being a major player in the software industry, Brøderbund hoped to encourage other companies to follow in its footsteps and offered some of the tools to help them do so:

> Brøderbund and the Alliance are currently working to incorporate more access features into future Brøderbund products and hope that this announcement will encourage other software developers to make a similar commitment to creating products with inherent accessibility features. Brøderbund has already prepared preliminary guidelines for accessible software design and is applying these to current products in development. Both organizations are prepared to provide assistance to other software developers that are interested in developing software that includes this important market.[540]

Brøderbund's long-term success in the volatile software industry and reputation for being a creative haven for programmers who produced innovative software put the company at the forefront of the industry—a place from which other software developers would follow. Brøderbund hoped to use this leverage to spread the value of universal design and accessibility for people with disabilities. Brøderbund also adopted methods of communication between different parts of the development process, as well as other third-party vendors, to increase knowledge of accessibility needs.

> They have established an internal bulletin board to which information related to access is posted for everyone's use. And engineers, product managers, and sales staff are collaborating with other vendors in the field to create solutions that mean greater access to Brøderbund software. By assessing the needs, addressing the issues, and identifying the steps that need to be taken, Brøderbund is making its products universally accessible and leading the way for other mainstream software developers.[541]

---

[540] Ibid.

[541] The Alliance for Technology Access. *Computer Resources for People with Disabilities,* 41.

Even if the company was exaggerating its hopes for the results of its work with the ATA, Brøderbund did institute corporate-wide structures to make programming in accessibility features part of their standard development process and to communicate that work both internally and to other parts of the software industry. While it is unclear to what extent Brøderbund was able to impact other software developers in improving their own accessibility, Brøderbund did demonstrate how they had performed in taking these goals of accessibility to heart.

One of the outcomes of Brøderbund's partnership with the ATA was a 1997 evaluation of the accessibility of Brøderbund's products.[542] The tests Brøderbund and the ATA ran went beyond just determining if a user could operate certain aspects of the software, and instead were focused on the skills the user would gain by performing certain activities with the software. Specifically, the evaluation looked at process and academic skills that children with learning disabilities needed to develop. The key question in evaluating the software was, "Does this activity provide the opportunity to foster these skills or qualities without facilitation or intervention?"[543] The emphasis was on both the skills the child should be gaining and their ability to operate the software independently. The skills being tested for included general "process skills," such as concentration, hand-eye coordination, auditory perception and discrimination, visual perception and discrimination, memory, communication, logic, and strategic and creative

---

[542] Poster. "An Evaluation of Broderbund Software Products: Process Skills, Academic Skill, Access Features, Compatibility with Assistive Technology Devices: For Children with Learning Disabilities and Distinct Learning Styles: A research study conducted jointly by Broderbund Software and The Alliance for Technology Access." 1997, box 2, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley.

[543] Ibid.

thinking. The academic skills included problem solving, reading, writing, spelling, and mathematics. In addition, the software was also tested for the presence of common accessibility features and its compatibility with assistive devices. The ATA conducted the software tests using an Education Advisory Team made up of members of Alliance centers who had expertise in learning disabilities, working with children, and product testing. They extensively evaluated five of Brøderbund's educational software titles that targeted writing, reading, math, logic, and drawing for each of the process and academic skills.

The results of the ATA's Education Advisory Team evaluation of Brøderbund's software were published in the form of a poster for educators and parents to use when selecting appropriate software.[544] A chart detailed how each of the five software applications promoted the improvement of the process and academic skills, as well as the common accessibility features found in each program. In addition, the poster provided information on how well titles in the larger Brøderbund catalog worked with assistive devices. The assistive devices tests were conducted on both Macintosh and Windows systems, along with some DOS testing for DOS versions of software. These tests included titles from Brøderbund's educational software, the popular video game *Where in the World is Carmen Sandiego?*, and the home printing and graphics program *The Print Shop*. All of the software titles were determined to be compatible with the tested alternative keyboards, switch input devices, screen enlargement software, touchscreens, and electronic pointing device.

Brøderbund was by far the most prominent software company to become a vendor

---

[544] Ibid.

member of the ATA and work with the Alliance to improve the accessibility of personal computer software for users with disabilities, but they were were not the only company to do so. The ATA singled out two general educational software publishers, Edmark and Hartley Courseware, for joining in Brøderbund's efforts to partner with assistive device developers to create custom overlays for alternative keyboards that would allow users easier operation of their programs with such devices.[545] Education software publishers were tapping an obvious market in targeting their products to include special education focuses. Keeping in mind universal design concerns regarding the use of their products by people with various needs brought more users into the consumer software market. Being able to market the accessibility of their products provided both positive press for software publishers and expanded their consumer base to include more people with disabilities.

6.3 Alliance for Technology Access Publications

In addition to their work with software companies to improve accessibility, the Alliance for Technology Access also produced two publications during the mid-1990s that codified their views on computers and people with disabilities. The ATA published the first edition of their book, *Computer Resources for People with Disabilities: A Guide to Exploring Today's Assistive Technology*, in 1994, providing a guide for people looking for accessible personal computer technology and coalescing many of the ideas and values that had driven the ATA since its founding.[546] The book immediately met with success;

[545] The Alliance for Technology Access. *Computer Resources for People with Disabilities,* 41-42.
[546] The Alliance for Technology Access. *Computer Resources for People with Disabilities.*

within eight months after its initial publication, it was already on its third printing.[547] Two years later, a revised and updated second edition of the book was published, with a third edition following in 2000 and a fourth in 2004.

While the book does offer information on useful resources, such as companies that produced certain kinds of technologies, similar to other resource books for people with disabilities that I have discussed, its main focus is on ways for people to approach computer technology as a means to solve specific problems and includes case studies of real life users and their experiences. Using a celebratory rhetoric centered on individual abilities, solutions, and raising expectations, the book addresses the computer user with disabilities directly. I analyze the book as a literary text, breaking down these different aspects of the ATA's rhetoric to examine the organization's perspective on disabilities and technology which emphasized the role of technology as empowering people to achieve their individual goals and the progressive trend toward greater accessibility and more usable technology. People with disabilities are the intended audience of the book and the ATA pushed for users themselves to make decisions, where possible, about the technology they would use.[548]

It is the expectations that these users have for themselves and their use of technology that the ATA believed was essential to making technology able to change people's lives for the better:

> The success of technology has more to do with people than machines. All the right parts and pieces together won't work miracles by themselves. It is people who make technology powerful by creatively using it to fulfill their dreams. The evolution of

[547] Annual report. "1994 Program Impact Report: Redefining Human Potential: The Partners, Progress and Promise of the Alliance for Technology Access," Bob Glass, box 1, folder 5, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 19.

[548] The Alliance for Technology Access. *Computer Resources for People with Disabilities,* 2.

> the field of assistive technology is more about the evolution of people and their expectations than it is about circuitry.[549]

From the ATA's perspective, people with disabilities had had low expectations placed upon them for too long; in order to fulfill their own personal goals in life, people needed to throw off what was expected of them and embrace seemingly “unrealistic” expectations. Historically, the Alliance saw an evolution in the expectations people with disabilities had placed on them and placed upon themselves. “There has never been a better time for an individual with a disability to challenge all of the stereotypes and notions of 'unrealistic' expectations existing in our culture. Not only do we have the right to envision and develop unrealistic expectations, but we have the right to achieve them.”[550] Technology could provide the opportunities for people with disabilities to live up to these unrealistic expectations. The significance of this for people with disabilities was that the expectations deemed unrealistic for them were expectations that were utterly normal for nondisabled people. Assistive technologies were a step toward equity, in making the expectations for people with disabilities more like those for people without. The two—expectations and technology—fed into each other here; the expectation that technology would be there to help people accomplish their goals furthered the development of technological improvements as developers' awareness of the needs of people with disabilities increased and more people with disabilities entered careers in technological development.

However, the ATA did not intend to send a message that technology—especially computer technology—would always be a quick or easy fix. The book emphasizes the

[549] Ibid., 8.
[550] Ibid., 127.

individual nature of computer technology—that what works for one person and their circumstances may not work for another. The computer is to be seen here again as a tool that can solve problems and provide opportunities, but the right combination of technologies will need to be found in order to fit an individual's needs.

> You may be able to reduce confusion by realizing that technology decisions are very personal. There is no one best computer, no one best software title, no single universal access device. There are only tools to be found that work well for you in your circumstances.[551]

Universal design, at this time and now, was an ideal to be encouraged, but not actually capable of achieving the results it strove for. No technology can be designed to meet the needs of all users. What technology allows is a way to empower people to achieve their goals. The Alliance treats technology as neutral here; it is a tool whose use is determined by the creativity of people. The values embedded in a technology, in its design, marketing, and distribution, are absent from this account—other than the possibilities of technology to benefit people's lives. The optimistic, celebratory tone of the book may be deliberate; by missing some of the negative aspects of technology, the user is shown only ways that they can improve their own lives.

As a way of focusing more on empowerment than obstacles, the book asks the user questions based on what they are able to do (their abilities) and what they want to accomplish with computer technology, as well as the difficulties they might have. Unlike the books by McWilliams and Bowe that I discussed in chapter 3, the ATA book is not organized by type of singular disability, but instead by these specific questions of degree of different abilities. For example, instead of listing technologies appropriate to blind or

[551] Ibid., 63.

visually impaired people, the ATA provides charts that suggests different tools for people depending on the degree of sight they have. This organization structure allows for the user to pick and choose tools to solve different problems they encounter when using a computer. The ATA's approach is in line with the growth of universal design ideals since the 1980s; by focusing on specific needs, rather than disability categories, the book guides users to advice that fits their individual circumstances.

The ATA shows the special place technology has in the lives of people with disabilities, as it not only allows them to overcome social barriers preventing equal participation, but it can also provide opportunities that they might otherwise not have available to them. The ATA describes this in terms of someone being able to make choices about how to live their life:

> In every sense of the word, *empowerment* is an attitude available to everyone with a disability. The law provides the legal rights and sanctions, but technology and imagination provide the real capacity and ability to choose, to act and to invent your future.[552]

Legislated anti-discrimination was insufficient to allowing people with disabilities equal participation in society; technology could provide the next step in fulfilling the promise of civil rights legislation, such as the ADA. The ATA also emphasized the role of imagination here, as both an encouragement of people to reach for their goals and an awareness of the difficulties in making these technologies work for individuals. To stress the importance of individual choices and experiences in using technology, the Alliance's book includes both general advice and specific case studies of real people.

The ATA's book uses accounts of actual computer users with disabilities to give a

[552] Ibid., 124. [Italics original]

concrete human perspective to their guide of technological solutions. Notably, the foreward to the book was written by Stephen Hawking. In it, he discusses the role technology plays in allowing him to communicate with other people.

> This book is about problems of expression and communication, and how to solve them. ... I, and thousands like me, have been helped to communicate by modern technology. Indeed, the fact that I have been asked to write this foreward is a sign of what technology can do.[553]

Hawking goes on to describe, in detail, the problems inherent in trying to communicate without speech. He describes it in terms of rate of information flow: speech can produce between 120 to 180 words per minute, whereas average typing is limited to between 40 to 60 words per minute. His ability to communicate is further complicated by his disabilities; he can only operate head or hand switches, not a full keyboard, which would make spelling out each word a time-consuming process. Computer technology, however, allows Hawking to select whole words or phrases, instead of individual characters, at a rate of about fifteen words per minute. Though this is not as fast as he would like it to be, Hawking remains optimistic in his view that, "the promise of computer technology is that improvements are always in development."[554] One aspect of improvement he has observed is in speech synthesizers. Hawking asserts that everyone wants to sound human, not like a machine or cartoon, and that speech synthesizer technology was finally at the point where that was becoming possible.

Hawking uses this example of his search for technology that allows him to speak to demonstrate what the ATA's book attempts to provide for others: "I hope others find in this book the inspiration and the technology, hardware and software, that can help them to

553 Ibid., vii.
554 Ibid., viii.

communicate better—to express their human-ness."[555] The need to express one's humanness was fulfilled for people such as Hawking through the use of communication technologies, by being made intelligible and able to participate in society. Equating humanness with verbal communication capabilities, however, created a singular definition of what it means to be human, while instantiating the necessity of using assistive technologies that provide for certain methods of communication. The ATA echoed the importance of people being able to communicate as one of the actions made possible with accessible computer technology, as well as the more problematic aspects of the technology. Their rhetoric celebrated computer technology's furnishing of abilities an individual might lack, without acknowledging what it might mean for someone to be dependent on technology in order to perform such expected aspects of human socialization. After Hawking's account, the rest of the users featured in the ATA book are actual clients or members of ATA centers, presenting shared stories of finding individual solutions to problems through the use of computer technology.

In one account, Tom, a former rehabilitation professional and co-founder of a self-advocacy group for people with disabilities, related his use of technology in helping him achieve a feeling of equality. For Tom, technology helps to erase the differences that are castigated by society and to embrace those that make people unique:

> 'What I am and who I am comes from my interaction with the environment. This technology—in spite of some of the problems with it—is enabling. I see young kids with cerebral palsy and speech difficulties in school using speech output. I see technology helping me to be seen as an equal. I am deeply impressed by how much more equal people with disabilities are because of technology. They have the power to communicate and the power to be more accepted and acceptable. People are less different. Technology allows people to be different on their own terms, rather than

[555] Ibid.

on society's terms.'[556]

As with Hawking, communication, for Tom, is how people are able to express that which makes them human and technology is the means through which such communication becomes possible. The ATA reiterates their point about the necessity of communication: "Everyone needs to connect with other human beings, especially youngsters with disabilities. Technology has the power to bring people together by providing them with the ability to interact and communicate in new ways."[557] The quickly growing availability of on-line services at this time was one of the new forms of communication computer technology was making possible, and also one of the ways computers helped people like Tom to feel like they could be seen as equal. These new technologies also broadened the types of communication that were possible with the personal computer, allowing for some of the erasure of the stigma of disability that Murray Turoff had proclaimed with computerized conferencing.

Underlying these concerns with being able to interact with other people regardless of disability was the desire on the part of people with disabilities to be seen and treated the same as everyone else. That people with disabilities were not inherently different was also at the core of universal design. People need or want to use technology differently and these different ways can be accommodated by building in flexibility and options in how a technology is used. The differences between people matter for universal design insofar as developers need to be aware of the different abilities people possess, in order to understand their individual needs. There is no hard distinction between people with

[556] Ibid., 16-17.
[557] Ibid., 117.

disabilities and those without; universal design attempts to accommodate everyone's needs, no matter what those might be. The ATA emphasized this point in their book by making it clear that they were not only focused on specialized, assistive technologies, but more generally on methods of creating access to conventional technologies:

> Much of what individuals with disabilities want is simply access to conventional technologies. You want to be able to write with a word processor. You want teachers to be able to read your writing. You want to publish a newsletter. You want your child to be able to draw and experience the process of creating pictures. You want to be able to create and perform music on a synthesizer. You want to play the latest computer games. You want to work a cash register. Your daughter needs access to a patient tutor for learning her multiplication facts.[558]

People with disabilities and those without share many of the same everyday goals that are accomplished with technology. Universal design offered the means through which technologies could be made to work for people regardless of disability. The ATA argued that the growing acceptance of universal design was beginning to change the way computer technology was developed, in terms of usability.

> The distinction between assistive and conventional technologies is becoming less clear as the concept of universal design is incorporated into conventional technology. Both fields are broadening and converging. What is a necessity for some is convenience for all.[559]

As developers became more aware of the needs of users with different abilities and the benefits that incorporating universal design into their development process could have, the Alliance saw real improvement in the flexibility of computer technology.

After the success of their book publication, the ATA released a short video, *Quality of Life: Alliance for Technology Access*, in 1995, promoting the work done by Alliance centers and drawing attention to the need for accessible technology in the lives

---

558 Ibid., 33.
559 Ibid., 40.

of people with disabilities.[560] The cost of producing the video was underwritten by IBM's Special Needs Systems with help from past ATA supporters Brøderbund Software, Pacific Bell's Deaf and Disabled Group, IntelliTools, and Living Books.[561] One of the major themes presented in the video is individual empowerment for people with disabilities through control over one's own life with the aid of technology. In it, Jackie Brand explains the value of independence within the ATA, “At the heart and the soul of the Alliance for Technology is a belief in certain values that say it's time for people with disabilities to take their place in the world alongside everybody else, to determine their own futures, to make decisions about their own life and to have the chance to achieve their most outrageous dreams.”[562] Brand sees the ATA as providing places where people can find technology that will enable their independence.

Jean Issacs, the Educational Director of the Alliance center in Lexington, Kentucky, echoes the importance of technology allowing people to take control of their own lives, and in particular, for children with disabilities who may otherwise have few opportunities to make decisions for themselves. Issacs explains that being able to watch children have such an experience is one of the reasons she works for the center:

> You know, it's that special moment that happens when we get a kid in here who's never experienced a switch toy and for the first time controlling their environment when they hit that switch and the clown laughs or the train shouts “I think I can, I think I can.” It's just a real magical moment and I almost feel like I have the greatest job in the world because I get to share these things with other families and the kids and make a difference in their lives.[563]

---

[560] Video cassette. *Quality of Life: Alliance for Technology Access*. (Created by the Alliance for Technology Access, 1995), VHS, 11:00.

[561] At this time, the Living Books series was no longer wholly published by Brøderbund, but was now a co-owned subsidiary with Random House.

[562] *Quality of Life*.

[563] Ibid.

Issacs's account is similar to the way Brand talked about her daughter Shoshanna's early experiences with computer technology. The Brands taught Shoshanna to use a Unicorn keyboard by programming it to respond to any press of it—showing their daughter that it was her decision to act that the computer was responding to and that she could have such an effect on her environment. The versatility and adaptability of computer technology allows it to be responsive in this way; a single switch operated by any muscle in the body can enable a user full control of a personal computer to do with it as they wish. For people with disabilities who may otherwise struggle with control over their lives—either because they are assumed to be unable to do so or face social barriers which remove their choices—the independence provided by the computer offers one place where they can be fully in control.

The *Quality of Life* video also emphasizes another important aspect of the ATA's mission, that of bringing people and knowledge together through the network of ATA centers. A client of the ATA center in Littleton, Colorado and parent of a child with a disability, Christy Blakely, talked about how she was able to share experiences with others in order to not have to solve every problem on her own.

> The Alliance gave us people and a place to seek out the answers for what was available, for when we came up with a problem. It also allowed us networking capabilities with other families, other parents, other families so that we weren't recreating the wheel. So that we were saying "Has anybody ever come up against this?" and they could direct us to another family that maybe had done that or who had experienced what we were going through. A place to feel like we're not going it alone.[564]

Much of the history of people with disabilities in American society is of isolation. By offering a place to find commonality with others, the Alliance helped to fight against one

---

[564] Ibid.

of the stigmas of disability and provide a way for people to solve their problems using both technology and each other.

The ATA believed that technology is the means to providing access to participation in society for people with disabilities. Blakely praises the role technology plays in opening up the world for her daughter, “It really allows them access to the world and it's going to make a population of kids that have a chance to be productive adults.”[565] Technological accommodations had helped people with disabilities to find employment and participate in social activities since legislation in the 1970s had begun to require them. For parents like Blakely, technology was continuing to offer children with disabilities new ways to engage with others, learn, and look to a future of greater independence and social involvement. From the perspective of a computer user with disabilities, Dr. David B. Rogers discusses the role technology plays in allowing him to continue as a clinical genetisist after becoming disabled, “Well, I'm using technology to access the world. Whether I'm working or playing, writing a letter or playing a game. Or doing a literature search like I'm doing that right now.”[566] His positive experiences with the ATA helping him to find out about technology led Rogers to becoming a boardmember at the ATA Computer Access Center in Santa Monica. As with the ATA's book, this video they created spread the message that people with disabilities were capable of living productive, independent lives and that computer technology was the tool that could enable them to do so. The Alliance's overall success and growth during the 1990s was matched by similar success and growth at its individual centers, particularly

[565] Ibid.
[566] Ibid.

the Disabled Children's Computer Group.

6.4 The Center for Accessible Technology

The 1990s saw the Disabled Children's Computer Group expanding—becoming inclusive of more computer users and utilizing new kinds of computer technology to benefit them—while continuing to remain focused on the Berkeley area. After years of internal debate regarding a name change, the Disabled Children's Computer Group became the the Center for Accessible Technology in 1994. The group felt that a name change was necessary to better reflect the population they served—that it included adults with disabilities just as much as children. At a board meeting, in January 1992 a name change and broadening of the mission and goals of the DCCG was proposed, now that some of the group's original clients were adults. At this time, they attempted to keep the D.C.C.G. acronym, but alter its meaning to encompass adults.[567] An unnamed board member wrote down ideas of ways to accomplish this in their copy of the meeting minutes; the two alternatives they listed to change “children's” to “community” or “citizens.” The group sought continuity with their past and the community they had established, yet needed to become more explicitly inclusive. These attempts to finagle their acronym without changing it would fail, and in 1994, the DCCG adopted an entirely new name: the Center for Accessible Technology (the CforAT). This new moniker not only better reflected their focus on people with disabilities of all ages, but also on the work the group had done with all kinds of technologies—not just computers.

[567] Meeting notes. "Board Retreat (April 26, 1992) Position Statements (as revised by the Executive Committee)." 1992, box 1, folder 3, Coll. BANC MSS 99/185c, Bancroft Library, University of California, Berkeley.

With its change in name, the CforAT officially brought adults with disabilities under the scope of its services. In 1995, the group began conducting evaluations and training for adults who were Department of Rehabilitation clients or beneficiaries of Worker's Compensation. In addition, corporations that dealt with accessible technology could also access CforAT services. These services still took place within the CforAT's Resource Center. The Resource Center continued to be the way the group connected with the local community, where: "The opportunity to get one's hands on the technology, to be able to learn and make decisions, and the support to implement new solutions, remain our goal."[568] This focus on hands-on technology exploration continued in the CforAT's Open House Resource Sessions, where anyone in the community, as well as technology vendors, could come in and explore technologies and share their expertise with others. In addition, the CforAT had its one-on-one services, now called Guided Explorations, that dealt with specific individual's problems. The Resource Center also conducted various seminars and classes, for parents, teachers, and children, along with special Play Groups where children with disabilities could try out accessible toys.[569]

In addition to their locally-focused services at the Resource Center, the CforAT also began larger scale programs in the mid-1990s, such as the PlaneMath project. This project is an example of a type of computer accessibility relating to software which increasingly became a priority at this time: internet websites. PlaneMath was a joint effort between NASA and InfoUse to develop an educational website in mathematics and aeronautics targeted at children in grades four to seven with physical disabilities. A

568 Annual report. *Center for Accessible Technology: a community-based technology resource center: 1995 Annual Report,* box 1, folder 2, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 2.

569 Ibid., 3.

number of ATA centers worked to help local schools access the website, with the CforAT taking the lead in donating staff and other resources. The project attempted to address two needs: to improve math education for students who had disabilities affecting their use of tools commonly found in math classes (such as pencils, calculators, and geometric models) and to encourage children with disabilities to consider careers in aeronautics which required the development of math skills. A website was the chosen method to achieve these goals, as, argued by the program: "The Internet, with its multimedia and communication capabilities, holds great potential for allowing these issues to be addressed."[570] The site took full advantage of the multimedia technology of the time; activities geared toward teaching students how to use math to solve aeronautics related problems used graphics, animation, and audio narration. The lessons also taught students information about airplanes and aeronautic careers. The full project only appears to have run for around two years (the final update was in December, 1998) and during that time was recognized by a number of organizations reviewing useful educational websites.[571]

The CforAT was involved in the PlaneMath project by providing help in constructing the lessons and advice on making the project itself accessible to students with disabilities.[572] There were two forms that accessibility took here: websites provided access to new ways to learning, but at the same time, they needed to be made accessible in order to work with assistive devices. However, unlike with one's own personal computer, where users may opt between different brands of software to find one that

[570] "1. Overview of Program," InfoUse, accessed August 29, 2012, http://infouse.com/planemath/overview.html.
[571] "PlaneMath News Flashes!" InfoUse, accessed August 29, 2012, http://infouse.com/planemath/planemathnews.html.
[572] Annual report. *Center for Accessible Technology: Annual Report 1997,* box 1, folder 2, Coll. BANC MSS 99/185c, Bancroft Library, University of California Berkeley, 6.

works best for them, they have no control over what the developer of a website has chosen to provide. Websites have to follow accessibility standards in order to work with assistive devices, such as screen readers. If they do now, certain websites may be inaccessible without any recourse for the user.[573] Websites are less personal than the personal computer as a whole; they are more like public buildings which users visit and require access to.

A document was prepared by CforAT staff that addressed issues of website accessibility for the PlaneMath project.[574] It described the built-in accessibility features of PlaneMath, such as large buttons in consistent locations, large text size, clear and relevant graphics, a text-only alternative version of the site to be used with screen readers, and alt tag descriptions of all images.[575] The document also provided general advice on internet browsers and assistive technologies, as well as technical information on specific assistive technologies that people might want to use with PlaneMath (e.g. text-to-speech software or keyboard access to certain web browsers). The site as a whole was designed to be accessible with a variety of common assistive input devices, such as alternative keyboards or voice input systems. In terms of output, the only limitation was with the lessons involving animation, as these could not be understood by a screen reader. Text-only pages of the animation narration were provided as an alternative, but the activities themselves that used the animation plug-in were inaccessible to screen readers and no

---

573 Website accessibility is today a major focus of disability activism and anti-discrimination lawsuits. I discuss some of these current issues in my conclusion.

574 Kristen Haugen et al., "Creating Access to PlaneMath," InfoUse, last modified May 15, 1998, accessed August 29, 2012, http://infouse.com/planemath/accessdoc.html.

575 "Alt tags" are a part of HTML (the language websites are written in) that provide a text description of images that screen readers can access, so that users can understand what an image shows without having to see it.

alternative to them was provided for vision impaired users.

While it is unclear how many teachers or classes utilized PlaneMath or what kind of impact it had on the education of children with physical disabilities, it does appear to have been well advertised by the organization involved in its development and well recieved by education related websites. PlaneMath does not list the total number of teachers who registered their classes with the project, but does list seventeen teachers from all across the country who registered on the site and won randomly chosen prizes donated from corporate sponsors. NASA advertised the project in a 2001 video segment on their website geared toward children.[576] The segment demonstrates how to use the PlaneMath site, with students visiting a museum testing it out. InfoUse also presented on PlaneMath at the 1999 CSUN Technology and Persons with Disabilities Conference. Through their involvement with InfoUse and NASA, the PlaneMath project created a venue for the CforAT to reach far beyond their local Berkeley-area community and offer resources for teachers and students all across the country. The internet provided a technological means for the local advocacy group to expand its efforts and write the needs of children with disabilities into the development of educational tools. PlaneMath demonstrates an early example of website accessibility pertaining to education, before the lawsuits starting in the mid-2000s began to enforce the following of accessibility standards.

---

[576] "Plane Math Online Activity," NASA video, 2:11. 2001, accessed August 29, 2012, http://www.nasa.gov/mov/196829main_066_Plane_Math.mov.

6.5 Brand and Brightman Move On

My history of the development of personal computer accessibility and its relationship with computer users with disabilities ends in the late 1990s, as personal computer technology reached a level of stabilization and accessibility standards became more normalized. This was also the time when two of my main subjects moved on from the organizations they had helped found; Jackie Brand left the Alliance for Technology Access in 1997 and Alan Brightman left Apple Computer's Worldwide Disability Solutions in 1998. Brand had remained as the ATA Executive Director until this time, when she was replaced by Frederick Fiedler. Fiedler continued in Brand's steps leading the ATA as the parent of a child with a disability, but, unlike Brand, he brought a technical education and management background to the position. Fiedler was a retired Air Force Major General, had degrees in engineering, and experience managing organizations.[577] His was a far more formal expertise, compared to the Brands' self-taught tinkering that had led them to found the CforAT fourteen years previously.

Jackie Brand's next project, the Universal Service Alliance (USA), an offshoot of the ATA, transferred the kind of network building and knowledge exchange she set up there to issues surrounding access to telecommunications technologies for underserved populations in California. Moving beyond serving only people with disabilities, the USA worked to address the growing divide between populations who had access to internet and other telecommunications technologies and those who did not.[578] The USA connected

---

577 Press release. Mary Lester, "New Executive Director to Lead Alliance for Technology Access into the 21st Century," Alliance for Technology Access press release. February 14, 1997, box 2, folder 6, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley, 1.

578 Brand, “Parent Advocate for Independent Living,” 95.

together a diverse set of activist groups representing Hispanic, African-American, Asian-American, Native American, and rural communities. Brand viewed people with disabilities as facing some of the same problems as other disadvantaged groups: "And here's a situation where it seemed to me that people with disabilities, though having some unique issues about access, in many ways were exactly in the same shape as many other communities who were also at risk."[579] Her plan for the USA was to have a disability organization take the lead in bringing together people from other populations, utilizing the expertise that disability advocates had developed during the previous two decades promoting accessibility and technology.[580] The assembled network of various organizations held public forums to communicate directly with underserved people about issues surrounding access to telecommunications technologies and worked with telecommunications companies to improve access for everyone.

One of the organization's most prominent actions was to manage the $50 million that Pacific Telesis and SBC were required to provide for the use of improving access to telecommunications technologies in underserved communities, as a result of the merger of the two companies in 1997. The Community Technology Foundation of California was created by the USA to manage these funds.[581] Their intention was to increase telephone access in low-income and minority communities to 98%, by providing improved infrastructure, services, equipment, training, technical assistance, and consumer education. Brand hoped the project would encourage these companies' competitors to join them in improving access to telecommunications technologies, a goal backed up by

579 Ibid.
580 Ibid., 95.
581 Ibid., 100.

Pacific Telesis's promise to match funds donated by other companies.[582] Brand took the expertise she had developed in disabilities and technology and expanded her focus to help other people who faced disadvantages in accessing and using technology. People with disabilities were not set apart as the only population that encountered barriers to access; other marginalized groups, which also contained people with disabilities as well, faced similar challenges.

After leaving Apple Computer, Alan Brightman continued to work on improving the accessibility of computer technology for people with disabilities from within the computer industry. In early 1998, Brightman's group within Apple, Worldwide Disability Solutions, was fired by the company for cost-cutting reasons, as Apple attempted to recover from its near bankruptcy two years earlier. Brightman moved on to Yahoo and continues to run their disability group today. In a *Wired* article responding to the firing, Brightman criticized Apple for getting rid of what he saw as a significant benefit to the company: “Apple will say there are no sacred cows, and I buy that. But for what we cost, the return was enormous, not only in reputation and caché, but in dollars. But, I guess it was small enough to leave on the table.” Gregg Vanderheiden, of the Trace Center, echoed Brightman's perspective—that Apple was losing out on the potential market of people with disabilities by not having an in-house group dedicated to accessibility, “But now that they don't have people dedicated to working on the topic, they won't be at the top anymore.”[583] In a more recent interview, Brightman looked back on the Apple firing

[582] "Community Organizations Announce Support for Pacific Telesis -- SBC Merger; Company Pledges to Take Leading Role in Universal Service, Create $50 Million Community Technology Fund When Merger is Complete," *The Free Library,* October 15, 1996, accessed August 29, 2012, http://www.thefreelibrary.com/Community Organizations Announce Support for Pacific Telesis -- SBC...-a018763350.

[583] Bob Tedeschi, “Apple Pulls Plug on Sick Kids' Site,” *Wired*. May 15, 1998.

in more positive terms:

> I think at one point we just felt like we were done; that the accessibility was now in the DNA of the company. It didn't need us to grab the lapels of all the engineers and the image of disabled people as part of the rest of us, was now also part of the company.... So I guess we felt…some of our people left, went to other companies, times had changed and it was just…it was time; it was time to move on.[584]

Though he felt that Apple had ingrained accessibility into its development process, Apple would forget its commitment to people with disabilities in a number of major ways in the following years.

Immediately after firing Worldwide Disability Solutions, Apple forced a web site project of theirs, Convomania, to shut down. The site was a social gathering place for children with life-threatening diseases, providing connections to chat rooms and hosting mailing lists. Apple had promised to allow the site to remain active under a slightly different name (Convonation) and run by volunteers, but then threatened to sue when maintainers tried to make changes to the site, claiming that the company's property was being altered without consent. In the above *Wired* article, a spokesperson for Apple, Rhona Hamilton, admitted that the company had handled the situation poorly, "I think it was handled more from the corporate way of doing things than the way Apple is used to, but that seems to be happening a lot around here these days."[585] In spite of Apple's lack of support, the children and one adult volunteer were able to bring the site back to life on their own, rebuilding it from the ground up.

In addition to firing their own disability group, Apple would also stop supporting the Alliance for Technology Access. By 2000, Apple was no longer listed as a major

---

584 Brightman, "Assistive Technology Oral History Project."
585 Tedeschi, "Apple Pulls Plug on Sick Kids' Site."

supporter of the organization in its annual report.[586] IBM would replace Apple as the Alliance's main corporate supporter, starting with their donations in the early 1990s and continuing throughout the decade and into the 2000s, with Microsoft joining their efforts by the late 1990s. Some of the ATA's original supporters would also continue their contributions, such as IntelliTools and Pacific Bell.

By the late 1990s, much of what people like Brand and Brightman had set out to do almost two decades earlier had been accomplished; basic accessibility features had become standard in personal computers, more people with disabilities had access to their own computer, and technological challenges such as the GUI had been at least partially conquered. However, the fight to make accessibility an intrinsic part of the computer technology development process still encountered situations where people with disabilities were ignored. One of the most notable examples of the ongoing release of products that prevented people with disabilities from accessing them occurred with Microsoft's Internet Explorer 4, in 1997. Though IE3 had accessibility features that made it compatible with the screen readers used by people with vision impairments, in a move to challenge the rising popularity of rival internet browser Netscape Navigator and push out a browser with new features, IE4 broke with Microsoft's own accessibility standards, making it incompatible with screen readers. It lacked Active Accessibility, Microsoft's software programming interface that allowed any application to communicate directly with adaptive devices, including screen readers, so that they could pass on useful

586 The Alliance for Technology Access, "1999/2000 Impact Report: Identity Activities Impact Affiliations," accessed November 25, 2012, 12, http://web.archive.org/web/20100116130313/http://www.ataccess.org/about/impact2000/default.html. This report has since been removed from the ATA website. This copy comes from the Internet Archive capture of the page.

information to the user. According to communication between members of the Microsoft Accessibility Team and the National Federation of the Blind, accessibility concerns in IE4 had been overridden in order to release the product quickly.[587]

Microsoft responded quickly to intense criticism from the blind community and released a new version of IE4 a month later that fixed some of the accessibility problems, though screen reading software still did not work correctly with the changes introduced.[588] A year later, Bill Gates gave a speech at Microsoft's "Accessibility Day" where he admitted the error Microsoft had made in not prioritizing accessibility and promising to dedicate the company's attention to improving accessibility and preventing future problems.[589] This episode shows that even developers who seemed to have previously understood the physical needs of their diverse user base and instituted standards to allow for technological accommodation could ignore those needs when other corporate priorities loomed. The fight for personal computer accessibility—to allow all users to experience the benefits the technology can provide—still continues between developers and users with disabilities.

---

587 Curtis Chong, "Microsoft Takes a Big Step Backward," *Braille Monitor* 40, no. 11 (1997). http://www.nfb.org/Images/nfb/Publications/bm/bm97/bm971202.htm.

588 Curtis Chong, "Microsoft Promotes Accessibility." *Braille Monitor* 41, no. 5 (1998). http://www.nfb.org/Images/nfb/Publications/bm/bm98/bm980503.htm.

589 "Remarks by Bill Gates: Microsoft Corporation Accessibility Day," Microsoft, February 19,1998, accessed August 29, 2012, http://web.archive.org/web/20100909081706/http://www.microsoft.com/presspass/exec/billg/speeches/1998/accessibilityday.aspx. This speech is no longer on Microsoft's website; this link is to an Internet Archive capture of the page.

Chapter 7

Conclusion: The Promises of Personal Computers

At the close of the twentieth century, Raymond Kurzweil—seen in chapter 3 as an honorable mention finalist in the Johns Hopkins Contest on Personal Computing to Aid the Handicapped—outlined his views on the future course of computing technology in his book, *The Age of Spirtual Machines*.[590] A follow-up to his 1990 book, *The Age of Intelligent Machines*, Kurzweil uses the history of computer development to predict a twenty-first century revolution in the way we understand humanity, intelligence, and our relationship to our bodies—a revolution with particular salience for people with disabilities. A 2004 documentary, *Freedom Machines*, offers a more grounded perspective on people with disabilities and technology, considering the different kinds of potential assistive technologies hold for people and the difficulties in acquiring such technologies.[591] These two perspectives on what technology—specifically, personal computer technology—means for people with disabilities who use it, within the context of the development of accessible personal computer technology, exemplify some of the tensions that run through this history of accessibility in the computer industry.

Kurzweil believes that computer technology has the potential to augment both human intelligence and human bodies. He views this augmentation as a process which began with the computer's calculation capabilities: "Computers started out as extensions

[590] Kurzweil. *The Age of Spiritual Machines*.
[591] *Freedom Machines*, directed by Jamie Stobie (Richard Cox Productions, 2004), DVD.

of our minds, and they will end up extending our bodies."[592] Computer technology will evolve from performing calculations already beyond human capacity to machines which alter, improve, and ultimately replace parts of the body. This will eventually include even replacing the physical brain itself, as Kurzweil believes consciousness to be an emergent property residing in patterns of electrical and chemical activity, and that one day people will figure out how to duplicate and transfer it to a digital form. Kurzweil anticipates that the ability of computer technology to extend human bodies will help humanity solve core biological problems, including that of mortality itself, and that these changes, though only detected on the horizon in the late 1990s, will accelerate during the next century: "The twenty-first century will be different. The human species, along with the computational technology it created, will be able to solve age-old problems of need, if not desire, and will be in a position to change the nature of mortality in a postbiological future."[593] Computer technology and its derivatives, such as programmable nanotechnology, are the ultimate problem-solvers in Kurzweil's vision of the future.

The potential of computer technology, for Kurzweil, is a result of its superiority over biology; created by humans, machines lack the flaws and limitations of the body. This is especially true for the human brain. Following estimates of the exponential growth of the speed and processing power of computer technology, Kurzweil predicts that by 2020 a personal computer will be equivalent (in terms of speed and capacity) to a human brain. As this development occurs, technology will also increasingly be integrated into the body and brain. "We will enhance our brains gradually through direct connection

---

592 Kurzweil, *The Age of Spiritual Machines*, 130.
593 Ibid., 2.

with machine intelligence until such time that the essence of our thinking has fully migrated to the far more capable and reliable new machinery."[594] Kurzweil sees this progression leading to a state of technology triumphing over biology; by the end of the twenty-first century he predicts that human intelligence will no longer be a function of biological neurons, but of software connected to virtual bodies.[595]

Kurzweil's ideas for the future of computer technology and his foundation in accessible technologies come together in methods of solving the problems people with disabilities face. His solution calls for fixing the bodies of people with disabilities in order to allow them to function in a world not designed to meet their needs. Kurzweil provides a number of examples, both real and imagined, of the application of computer technology to accommodate disabled bodies. In a contemporary example, he discusses the use of neural implants to alleviate Parkinson's patients of their symptoms. These implants inhibit over-activation in the parts of the brain that cause the paralysis and stiffness of the disease. Kurzweil also discusses the use of similar neural implants to treat people with tremor-causing diseases, such as cerebral palsy and multiple sclerosis. The linkage of implant and body allows technology to directly affect the electrical impulses of the brain. "Increasingly, we are starting to combat cognitive and sensory afflictions by treating the brain and nervous system like the complex computational system that it is."[596] Both machine and brain operate using the same physical principles, allowing technology to override instances where parts of the brain malfunction in specific ways.

Another type of neural implant to benefit people with disabilities that Kurzweil

---

[594] Ibid., 135.
[595] Ibid., 234.
[596] Ibid., 127.

discusses is cochlear implants. Although the technology is highly contentious and considered by some Deaf activists as an attack on cultural Deafness, Kurzweil treats it unproblematically as a cure for a disability. He cites that, as of 1999, “About 10 percent of the formerly deaf persons who have received this neural replacement device are now able to hear and understand voices well enough that they can hold conversations using a normal telephone.”[597] The cochlear implant acts the same for the deaf person as the neural implant that allows the Parkinson's patient to move; it permits the deaf person to function the same as a nondisabled person. Moreso, for Kurzweil, the cochlear implant essentially removes the disability itself, rendering its user “formerly deaf” and allowing them to operate the “normal” communication technology of the telephone.

These accessible technologies that, for Kurzweil, remove the handicaps of disability also have the potential to affect nondisabled users. As I demonstrated with accessible personal computer technology, devices and features created with specialized uses for people with disabilities frequently diversified to include other kinds of use; many of these technologies improved usability and flexibility overall, allowing for more options in how users could interact with them. Kurzweil believes this transference of specific design to general use will occur between technologies that will erase disability to ones that will enhance humanity in general. Future neural implants, in particular, carry the potential to augment all human abilities:

> Directly enhancing the information processing of our brain with synthetic circuits is focusing at first on correcting the glaring defects caused by neurological and sensory diseases and disabilities. Ultimately we will all find the benefits of extending our abilities through neural implants difficult to resist.[598]

---

[597] Ibid.

[598] Ibid., 128.

This use of computer technology to alter human brains is not without its potential for abuse. In his predictions for the development of the technology, Kurzweil considers how it will change what it means to be human, for example in granting people technological control over their emotions:

> Once a technology is developed to overcome a disability, there is no way to restrict its use from enhancing normal abilities, nor would such restrictions necessarily be desirable. The ability to control our feelings will be just another one of those twenty-first-century slippery slopes.[599]

Though pharmaceutical technologies are already regularly used to control emotions, Kurzweil's slippery slope with computer technology is similar to the recreational use of pharmaceuticals: a technology intended to treat illness or disability applied to general use to alter aspects of the body.

Kurzweil's conception of the relationship between technology and disability is ultimately triumphalist. In many aspects, his discourse is similar to the disability activists and technology developers I examined. He hopes that computer technology will allow people with disabilities to have the opportunities which have been denied to them, the same opportunities available to people who are not disabled. By 2009, Kurzweil predicted that some of this equalizing would come to pass:

> There is a growing perception that the primary disabilities of blindness, deafness, and physical impairment do not necessarily impart handicaps. Disabled persons routinely describe their disabilities as mere inconveniences. Intelligent technology has become the great leveler.[600]

Kurzweil expresses the same hopes as disability and technology advocates, that computer technology would provide a more level playing field for people with disabilities by

---

599 Ibid., 150.
600 Ibid., 193.

accommodating their needs. However, his focus on solving disability by fixing what is wrong with the body differs greatly from the activists, developers, and users I followed. There is no attempt in Kurzweil's philosophy to change either social views or the built environment as a means of solving disability. For example, one of his predictions for future technologies—slated to begin use in 2009—is an orthotic walking machine for paraplegic people; these devices are to allow people who would otherwise use a wheelchair to be able to climb stairs. The body must adapt to the environment, not the other way around. Though he allows for flexible uses of technology, he misses the possibilities of technology in redefining norms in such a way that disabled bodies are not necessarily something that needs to be fixed in order for full participation in society to be possible.

Kurzweil's view of fixing the bodies of people with disabilities contrasts with the solutions suggested by the social model of disability. For Kurzweil, disability lies within individuals, to be solved individually. What he calls 'handicaps' are the social dimension of disability, the limitations people with disabilities encounter in society. His solution is to address the body, not society. Technology is the means to both directly fix bodies and to indirectly allow for abilities the body lacks; that is, even before computer technology progresses to a point where it can physically repair the body, it will still be able to overcome disabilities by granting people those abilities their bodies are incapable of (as assistive technologies do today). The personal computer, however, erases many of the distinctions between a technology which changes the body to fit society and one which changes the social environment to accommodate bodies. It lies somewhere between a prosthetic limb and a building ramp; the personal computer is both a personal technology—granting its user new abilities—and a social one—acting as a portal to sites of social interaction. It is a mediator between the body and the world. Accessible personal computer technologies both change what the individual is capable of and lead to social spaces where users with different kinds of abilities are all accommodated. The personal computer also acts to erase some of the distinction between disabled and nondisabled, by providing new abilities and augmentation for all users. For some people, the technology is more like Kurzweil remediation—overcoming the body's limitation; for others, it is more of a mode of access to the public sphere. And for some, the distinction between the two is meaningless; the personal computer provides for both.

Examples of some of the actual uses of accessible personal computer technology by people with disabilities and their meanings for users are examined in the 2004 documentary film, *Freedom Machines.*[601] The film, which was aired on PBS, interviews a number of people with disabilities on their experiences with assistive technology, along with disability activists—including Jackie Brand—pushing for greater availability and funding for such technologies. The technologies featured are mostly personal computer technologies and various types of wheelchairs. These people with disabilities, their families, and friends, provide a perspective on the promise of personal computer technologies that is grounded in the everyday needs of people trying to participate in society in the ways they choose.

The film argues that technological accommodations are necessary for equity to be achieved. Standing in the way of access to these technologies is a lack of resources. As

---

601 *Freedom Machines*.

Brand explains, “It's a terribly frustrating thing, to look at something you know would change your life so enormously and be so powerful for you and to know it's not to be had, because you don't have the resources and this society has not decided that it's important enough for you to have.” Other people in the film echo the difficulties in acquiring the technologies that might benefit them, or even learning about the existence of such technologies in the first place. As one woman discusses, “I thought that with all this technology surely there was something out there that a visually impaired person could use. But I didn't realize it had been out for years and I just didn't know about it.” As I discused in chapter 3, a lack of information can keep technology out of the hands of the people it is intended to benefit. Some form of social technology is necessary to communicate knowledge on what technology exists and how to use it to users, as well as provide a means for users to communicate their needs back to developers. With the activists I studied, the lines between these groups blurred, as many developers were also activists and many activists also users.

At the same time as it encourages greater access to technology, *Freedom Machines* also suggests that the best solutions to the problems of disability are those based in universal design, where the social environment is most fully made accessible to people with different needs, instead of requiring people to adapt themselves to the environment via their own personal technologies. Rich Kjeldsen, an inventor of accessible computer interfaces, argues for the need for flexibility in technology to better accommodate use:

> Right now we're in kind of an awkward stage, because technology is so rigid and fixed. And that's exactly what we're trying to do, is to make it more flexible, so that

> the technology adapts to us. And in that way, hopefully, we'll be able to open doors for everyone.

For these people most directly involved with accessible personal computer technology—its users and developers—the possibility of it truly acting as a leveler, of being one of the means of enacting equal rights, demonstrates its significance for people with disabilities. Though the filmmakers are aware of the difficulties in acquiring accessible technologies and in figuring out how to use them to meet individual needs, it is still ultimately a celebratory view of technology; the computer is presented as having the potential to allow new abilities and new forms of social interaction for people with disabilities. The promise of the personal computer, then, while not yet fulfilled and perhaps never will be, is in the values embedded in it that allow it to be used and changed to fit the individual needs of different users to be put to whatever uses they can imagine.

As I traced the development of accessible personal computer technology as it unfolded, I found a story about the struggling to fulfill the promise of the personal computer in order to benefit people with disabilities—people who the values embedded in the technology connect directly with. The personal computer values of openness, shared information, universality, and augmentation all come together in technologies which allow people with disabilities access to both new abilities and the same technological features for which everyone seeks to use the computer. From Kurzweil's perspective, I observed the creation of technologies to accommodate the individual physical needs of people, but I also found the work at the social level, to fund these technologies and disseminate them, that Kurzweil does not discuss. *Freedom Machines* provides a view of assistive technology and disability similar to the historical accounts I examine—grounded in the actual interactions of people with disabilities and their technology. My argument, however, extends beyond what is still a fairly individual look at technological use in the film, to consider the ways that accessible personal computer technologies are a necessary part of the enactment of civil rights and the possibility of full participation in society for people with disabilities. Only by examining the role technology plays in social equity can the full understanding of the meaning the technology holds for the people who use be found.

There are a number of points within this relationship between accessible personal computer technologies and civil rights that I have raised. In order for personal computers to be used by people with different abilities, they had to be made accessible to flexible kinds of use. Ideals similar to universal design were utilized to understand the different needs of users and to re-imagine who counted as a 'normal' user. Instead of averaging the needs of users and designing computer technology to fit that imagined, universal human, universal design calls for a universality composed of all possible differences. By understanding the variety of needs of users and accommodating those needs, technology can be universally usable. In the process of accessible computer technologies being developed, people with disabilities became the paradigmatic computer user, in the ways that the technology directly accommodated their abilities, as well as the transference which frequently occurred with features created for specialized purposes entering general use by people who did not identify as disabled. By increasing usability to meet the needs of people with disabilities, personal computer technologies were made more flexible and usable overall, accommodating many other kinds of use as well.

The history I have told has been a mostly celebratory one. While accessibility has not been built into the foundation of the personal computer development process as the activists had hoped and there remains a consistent lag between the release of a new technology and the updates which make it accessible, in many ways accessibility has still been generalized. Most computer companies have employees dedicated to promoting the development of accessibility for their products. Normalcy has come to be redefined, to an extent. When computer development takes into account the ideals of universal design and attempt to capture as many users as possible within their market share, who counts as the imagined user is a far larger group than it was previously. Accessibility is in many ways now mainstream and universal design is a buzzword in industry. Kurzweil was correct in that if accessibility and accommodating the needs of people with disabilities is addressed first, the usability of the technology to benefit all users will follow. By the end of my account, even when technologies are released which did not take accessibility into account, an infrastructure—of legislation, activists, and users—is now in place to patch the lack of accessibility. This network of laws, companies, organizations, and individuals which has developed since the 1970s works together to implement accessibility in personal computer technology and fulfill some of its more utopian promise. It is the responsiveness to accessibility and the needs of people with disabilities that changed during this history.

Unlike Kurzweil's transhumanist view of simply implanting the computer into the body in order to correct it and solve disability, what was historically required to bring people with disabilities into fuller participation in society was a political infrastructure that backed accessibility as an issue of equity and a change in corporate philosophy that saw people with disabilities as intended users. These changes in attitudes toward disability were a part of the cultural context within which the personal computer developed. The personal computer represents the possibility for changes in the meanings of disability and normalcy—a blurring of lines between categories that changes what is possible when assumptions about who counts as a user and how they might use technology are made to accommodate a multiplicity of needs.

Works Cited

Archival Materials

Alliance for Technology Access records, 1987-1999, Coll. BANC MSS 99/248c, Bancroft Library, University of California, Berkeley.

Center for Accessible Technology records, 1985-1998, Coll. BANC MSS 99/185,c Bancroft Library, University of California Berkeley.

Primary Sources

"1. Overview of Program." InfoUse. Accessed August 29, 2012. http://infouse.com/planemath/overview.html.

Adams, F.R., Crepy, H, Jameson, D.H., and Thatcher, J.W. "IBM Products for Persons with Disabilities." In *GLOBECOM '89: IEEE Global Telecommunications Conference & Exhibition, Dallas, Texas, November 27-30, 1989, "Communications technology for the 1990s and beyond"; conference record*, 980-984. New York, NY: Institute of Electrical and Electronics Engineers, 1990.

The Alliance for Technology Access. Computer Resources for People with Disabilities: A Guide to Exploring Today's Assistive Technology. Alameda, CA: Hunter House Inc., 1994.

_____. "1999/2000 Impact Report: Identity Activities Impact Affiliations." Accessed November 25, 2012. http://web.archive.org/web/20100116130313/http://www.ataccess.org/about/impact2000/default.html.

Americans with Disabilities Act of 1988: Joint Hearings on S. 100-926, Before the Subcommittee on the Handicapped of the Comm. on Labor and Human Resources United States Senate and the Subcommittee on Select Education of the Comm. on Education and Labor House of Representatives, 100th Cong. (1988).

Apple Computer. *Simplicity is the ultimate sophistication: Introducing Apple II, the personal computer*. Computer History Museum. http://www.computerhistory.org/brochures/full_record.php?iid=doc-43729572aadaf.

Architectural Barriers Act of 1968, 42 U.S.C. § 4151 (1968).

Borno, A.N. "A Lifeline to Society." *Think*, March 1972: 16-19.

Boyd, Lawrence H., Wesley L. Boyd, and Gregg C. Vanderheiden. "The Graphical User Interface Crisis: Danger and Opportunity." TRACE Center, September, 1990, http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED333687.

Bowe, Frank G. *Personal Computers and Special Needs*. Berkeley, CA: Sybex, 1984.

Brand, Jacquelyn. "Families Working Together." *The Exceptional Parent,* October 1985, 17-18.

_____. "The Disabled Children's Computer Group." *The Exceptional Parent,* October 1985, 16.

_____. "Parent Advocate for Independent Living, Founder of the Disabled Children's Computer Group and the Alliance for Technology Access." An oral history conducted in 1998-1999 by Denise Sherer Jacobson in *Builders and Sustainers of the Independent Living Movement in Berkeley, Volume V*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2000.

_____. “Assistive Technology Oral History Project.” Interview with Chauncy Rucker, November 1, 2007, http://atoralhistory.uconn.edu/podcasts/brand.php.

Bright, Herbert S. “Letter to SIGCAPH.” *SIGCAPH Newsletter,* no. 12 (1974): 7.

Brightman, Alan. "Microcomputers and Special Education: Lessons from Unreasonable People." In *Computer Technology for the Handicapped: Proceedings from the 1985 Closing The Gap Conference,* edited by Michael Gergen and Dolores Hagen, 1-6. Henderson, Minn: Closing The Gap, 1985.

_____. “Assistive Technology Oral History Project.” Interview with Chauncy Rucker, March 13, 2008, http://atoralhistory.uconn.edu/podcasts/Brightman.php.

Brody, Herb. "The Great Equalizer: PCs Empower the Disabled." *PC/Computing*, July 1989, 84.

Burruss, Kim. *CSUN's Child LAB Receives Gift of New Computers.* California State University Northridge, Press Release, Sept 22 1998. http://www.csun.edu/~hfoao102/press_releases/fall98/lab.html.

"CES to get Computer Learning Lab," *Cherokee County Herald*, Oct 23, 1991, 6A, accessed August 29, 2012. http://news.google.com/newspapers?id=T88vAAAAIBAJ&sjid=Xj4DAAAAIBAJ&pg=6859%2C1561202.

Chong, Curtis. “Correspondence on the GUI Problem.” *Computer Science Update*, National Federation of the Blind, Summer 1994. Accessed August 29, 2012.

http://cd.textfiles.com/nfbfiles/nfbcs/CS9406.TXT.

_____. “Microsoft Takes a Big Step Backward.” *Braille Monitor* 40, no. 11 (1997). http://www.nfb.org/Images/nfb/Publications/bm/bm97/bm971202.htm.

_____. “Microsoft Promotes Accessibility.” *Braille Monitor* 41, no. 5 (1998). http://www.nfb.org/Images/nfb/Publications/bm/bm98/bm980503.htm.

Cohn, Joseph T. “Microcomputer Augmentative Communication Devices.” In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 43-44. Los Angeles, CA: IEEE Computer Society, 1981.

Committee on Professional Activities of the Blind. *The Selection, Training, and Placement of Blind Computer Programmers.* N.p.: Association for Computing Machinery, 1966.

"Community Organizations Announce Support for Pacific Telesis -- SBC Merger; Company Pledges to Take Leading Role in Universal Service, Create $50 Million Community Technology Fund When Merger is Complete." *The Free Library,* October 15, 1996, accessed August 29, 2012. http://www.thefreelibrary.com/ Community Organizations Announce Support for Pacific Telesis – SBC...-a018763350.

Cummings, Gordon. “Blind Programmer Questionnaire.” *SIGCAPH Newsletter,* no. 8 (1973): 4-13.

“Developing a Parent / Community Technology Resource Center.” *Closing the Gap*, April 12, 1986, 1.

Dipner, Randy W. “The Micro-Braille System.” In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 244-245. Los Angeles, CA: IEEE Computer Society, 1981.

Divoky, Diane. "Apple Sponsors a New Alliance for Disabled Computer Users." *Classroom Computer Learning,* October 1987, 46-49.

Education for All Handicapped Children Act of 1975, Pub. L. No. 94-142 (1975).

“Flyer distributed at the March 1, 1988 Rally.” Gallaudet University. Accessed August 29, 2012. http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/ DPN_Home/Issues/Related_Documents/RallyFlyers.html.

Frasse, Kenneth. "GUI Access: A Comparison of Screen-Readers (Part I)." *Access Review*

II, no. 2 (1997). http://www.nyise.org/whatsnew/review.txt.

Freedom Machines, directed by Jamie Stobie (Richard Cox Productions, 2004), DVD.

Friedlander, Carl, ed. “Reduced Cost Microcomputers Available.” *SIGCAPH Newsletter,* no. 39 (1988): 5-6.

Friedman, Mark B., Gary Kiliany, Mark Dzmura, and Drew Anderson. “The EyeTracker Communication System.” In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 183. Los Angeles, CA: IEEE Computer Society, 1981.

Gildea, Robert A. J. “Chairman's Message.” *SIGCAPH Newsletter,* no. 10 (1974): 1.

_____. “Chairman's Message.” *SIGCAPH Newsletter,* no. 16 (1975): 1.

Glinert, Ephriam. “A Note From the Chairman.” *SIGCAPH Newsletter,* no. 52 & 53 (1995): 2.

Hagen, Dolores. *Microcomputer Resource Book for Special Education*. Reston, VA: Reston Publishing Company, Inc., 1984.

Harkin, Tom. "A View from Capitol Hill." *PC/Computing*, July 1989, 91.

Haugen, Kristen, Paul Hendrix, Mike Birkmire, and Lisa Wahl. “Creating Access to PlaneMath.” InfoUse. Last modified May 15, 1998, accessed August 29, 2012. http://infouse.com/planemath/accessdoc.html.

Hazan, Paul L. “Computer and the Handicapped: Guest Editor's Introduction.” *Computer,* January 1981, 9.

Heller, James H., David Salisbury, and Judith C. Lapadat. "The Unicorn Model 1 Keyboard As a Rehabilitation Tool." In *Computer Technology for the Handicapped: Proceedings from the 1984 Closing The Gap Conference,* edited by Michael Gergen and Dolores Hagen, 68-70. Henderson, MN: Closing The Gap, 1984.

Hight, Robin L. “Lip-Reader Trainer: A Computer Program for the Hearing Impaired.” In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 4-5. Los Angeles, CA: IEEE Computer Society, 1981.

Hiltz, Starr Roxanne, and Murray Turoff. *The Network Nation: Human Communication via Computer.* Reading, MA: Addison-Wesley Publishing Company, Inc., 1978.

Holland, Russ, Tom Morales, Regina Rodman, Dave Grass, and Kathy Perini. "The Mattel Family Learning Program - An Innovative Community Partnership." *Proceedings of the Technology And Persons With Disabilities Conference*, 1999. http://www.csun.edu/cod/conf/1999/proceedings/session0100.htm.

IBM National Support Center for Persons with Disabilities. *Technology for Persons with Disabilities: An Introduction.* N.p.: IBM, 1990.

"IBM VoiceType Simply Speaking Brings Speech Recognition Technology to Home, School, and Mobile Office," IBM Software Announcement, Letter Number 296-434, October 29, 1996. Accessed August 29, 2012. http://www.www-304.ibm.com /jct01003c/cgi-bin/common/ssi/ssialias?infotype=an&subtype=ca&htmlfid=897/ ENUS296-434&appname=xldata&language=enus.

Jackson, Sandra, Judy Maples Simmons, and Tony Wedig. "We Help More." In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 59-60. Los Angeles, CA: IEEE Computer Society, 1981.

Jaffe, David L. "An Ultrasonic Head Position Interface for Wheelchair Control." In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 142-143. Los Angeles, CA: IEEE Computer Society, 1981.

Kafer, Kathy. "A Fair Chance." *Think*, no. 3, 1988.

Kurzweil, Raymond C. "Kurzweil Reading Machine for the Blind." In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 236. Los Angeles, CA: IEEE Computer Society, 1981.

_____. *The Age of Spiritual Machines: When Computers Exceed Human Intelligence.* New York: Viking, 1999.

Larsen, Kari. "Reg.: Drop Braille Version? NO!!! (SIGCAPH no. 23)." *SIGCAPH Newsletter,* no. 24 (1978): 13.

Leffler, Lois, ed. "SIG/SIC Functions." *SICCAPH Newsletter,* no. 5 (1971): 2.

_____. "Bylaws for SIGCAPH." *SIGCAPH Newsletter,* no. 9 (1973): 7.

Lester, Mary. "Grant Writer for the Early Center for Independent Living in Berkeley, 1974-1981." An oral history conducted in March, 2000 by Susan O'Hara Jacobson in *Builders and Sustainers of the Independent Living Movement in Berkeley,* *Volume I*, Regional Oral History Office, The Bancroft Library, University of California, Berkeley, 2000.

Levitt, Harry. "A Pocket Telecommunicator for the Deaf." In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 39-42. Los Angeles, CA: IEEE Computer Society, 1981.

Lowney, Greg. "Message from Microsoft." *Computer Science Update*. National Federation of the Blind, Summer 1994. Accessed August 29, 2012. http://cd.textfiles.com/nfbfiles/nfbcs/CS9406.TXT.

McWilliams, Peter A. *Personal Computers and the Disabled*. Garden City, NY: Garden Press, 1984.

Muth, Wayne, ed. "An Idea: Should We Drop the Braille Version of SIGCAPH Newsletter and Shift to Cassette Tapes Instead?" *SIGCAPH Newsletter,* no. 23 (1978): 3.

_____. "The Shift to Tape Cassette." *SIGCAPH Newsletter,* no. 26 (1980): 2.

National Council on Disability. *Equality of Opportunity: The Making of the Americans with Disabilities Act.* Washington, D.C.: National Council on Disability, 2010.

National Council on the Handicapped. *Toward Independence: An Assessment of Federal Laws and Programs Affecting Persons with Disabilities—with Legislative Recommendations.* Washinton, D.C.: National Council on the Handicapped, 1986.

_____. *On the Threshold of Independence: Progress on Legislative Recommendations from "*Toward Independence". Washinton, D.C.: National Council on the Handicapped, 1988.

"National Support Center; a Service of IBM." *The Exceptional Parent*, *8th Annual Computer Technology Directory,* Nov 1, 1990, 2.

New Jersey Institute of Technology. "Research Activity... 'Computer Conferencing'...." *SIGCAPH Newsletter,* no. 25 (1979): 12-16.

Nondiscrimination on the Basis of Handicap in Programs and Activities Receiving or Benefiting from Federal Financial Assistance. 42 Fed. Reg. 22676 (May 4, 1977).

"Personal Computers Help the Handicapped: Johns Hopkins Rewards Inventors." *Creative Computing*, March, 1982, 54-55.

"PlaneMath News Flashes!" InfoUse. Accessed August 29, 2012.

http://infouse.com/planemath/planemathnews.html.

“Plane Math Online Activity.” NASA video, 2:11. 2001. Accessed August 29, 2012. http://www.nasa.gov/mov/196829main_066_Plane_Math.mov.

President's Council on Deafness. "Position of the Students, Faculty and Staff of Gallaudet University." Gallaudet University. Accessed August 29, 2012. http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/DPN_Home/Issues/Related_Documents/PCD_Demands.html.

Pressman, Harvey. "Jackie Brand: DCCG." *The Exceptional Parent* 17, no. 7. (1987): 57.

_____. “National Special Education Alliance.” *The Exceptional Parent* 17 no. 7 (1987): 12-18, 21-22.

_____. “The National Special Education Alliance: Applying Microcomputer Technology to Benefit Disabled Children and Adults.” N.p.: National Special Education Alliance, 1987.

Rehabilitation Act Amendments of 1974, Pub. L. No. 93-516, 88 Stat. 1617 (1974).

Rehabilitation Act Amendments of 1984, Pub. L. No. 98-221, 98 Stat. 26 (1984).

Rehabilitation Act of 1973. Pub. L. No. 93-112, 87 Stat. 394, 29 (1973).

“Remarks by Bill Gates: Microsoft Corporation Accessibility Day.” Microsoft, February 19,1998. Accessed August 29, 2012. http://web.archive.org/web/20100909081706/http://www.microsoft.com/presspass/exec/billg/speeches/1998/accessibilityday.aspx.

Rifkin, Glenn. "Competing Through Innovation: The Case of Broderbund." *Strategy & Business,* no. 11 (1998): 48-50.

Schwejda, Paul, and Judy McDonald. “Adapting the Apple for Physically Handicapped User: Two Different Solutions.” In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 53-54. Los Angeles, CA: IEEE Computer Society, 1981.

"Seventy years of enabling the disabled." *Think*, no. 3 (1988): 43.

SIGCAPH Newsletter. “SICCAPH Mid-Winter Meeting.” no. 6 (1972): 3.

_____. “Conferencing System for Handicapped.” no. 19 (1976): 1.

_____. "Personal Computing for the Handicapped (National Contest)." no. 29 (1981): 16.

Silva, Michael J., Brian P. Lee, Arjan S. Khalsa, and David C. Schmitt. Membrane Computer Keyboard and Method. US Patent 5,450,078, filed October 8, 1992, and issued September 12, 1995.

Simon, Paul. Paul Simon to Greg Hlibok, Washington, DC, March 10, 1988, in *Letters of Support*. Gallaudet University. Accessed August 29, 2012. http://www.gallaudet.edu/Gallaudet_University/About_Gallaudet/DPN_Home/Issues/Letters_of_Support/Senator_Paul_Simon.html.

Sinclair, Molly and Eric Pianin. "Protest May Imperil Gallaudet Funding: Some Members of Congress Back Movement for Deaf President." *The Washington Post*, March 9, 1988, A1.

Smith, Beth, John Duganne, Melinda Peters Todaro, Kim Holler, Greg Holler, Helen Smalley-Bower, Jacquelyn Brand. "Real People, Real Technology, Real Solutions." *The Exceptional Parent*, November 1994.

Stegmann, Claire. "Handicapped? Not on the Job." *Think*, July/August 1977, 42-47.

Stepp, Robert. "A Braille Word Processing System." In *Proceedings of the Johns Hopkins First National Search for Applications of Personal Computing to Aid the Handicapped*, 202. Los Angeles, CA: IEEE Computer Society, 1981.

Sterling, Theodor D., M. Lichstein, F. Scarpino, D. Stuebing, and William Stuebing. "Professional Computer Work for the Blind." *Communications of the ACM* 7, no. 4 (1964): 228-251.

Technology-Related Assistance for Individuals with Disabilities Act of 1988: Hearings on H.R. 4904, Before the Subcommittee on Select Education of the Comm. on Education and Labor, 100th Cong (1988) (statement of James Johnson, Director of Government Affairs, Apple Computer, Inc.).

Technology-Related Assistance for Individuals with Disabilities Act of 1988, Pub. L. No. 100-407 (1988).

Tedeschi, Bob. "Apple Pulls Plug on Sick Kids' Site." *Wired,* May 15, 1998.

Thatcher, James. "Problems and Challenges of the Graphical User Interface." *The Braille Monitor* 37, no. 1 (1994). http://nfb.org/Images/nfb/Publications/bm/bm94/brlm9401.htm#9.

Turoff, Murray. "Computerized Conferencing for the Deaf and Handicapped." *SIGCAPH*

Newsletter, no. 16 (1975): 5.

"User's Guide for AccessDOS." IBM, last modified January 21, 1997, accessed August 29, 2012. ftp://ftp.software.ibm.com/sns/accessd.zip.

Vanderheiden, Gregg C. *Curbcuts and Computers: Providing Access to Computers and Information Systems for Disabled Individuals*. Madison, WI: Trace Research and Development Center, 1983. http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED289314.

_____. *White Paper: Access to Standard Computers, Software, and Information Systems by Persons with Disabilities*. Version 2.0. Madison, WI: Trace Research and Development Center, 1985. http://www.eric.ed.gov/ERICWebPortal/detail?accno=ED280257.

Wozniak, Steve, and Gina Smith. *iWoz: Computer Geek to Cult Icon: How I invented the personal computer, co-founded Apple, and had fun doing it*. New York: W.W. Norton & Co, 2006. epub e-book.

Secondary Sources

Abbate, Janet. *Inventing the Internet*. Cambridge, MA: MIT Press, 1999.

Balsamo, Anne Marie. *Technologies of the Gendered Body: Reading Cyborg Women*. Durham: Duke University Press, 1996.

Bardini, Thierry. *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing.* Stanford, CA: Stanford University Press, 2000.

Blume, Stuart. "What Can the Study of Science and Technology Tell Us about Disability?" In *Routledge Handbook of Disability Studies*, edited by Nick Watson, Alan Roulstone, and Carol Thomas, 348-359. London: Routledge, 2012.

Borgmann, Albert. *Technology and the Character of Contemporary Life.* Chicago, IL: University of Chicago Press, 1984.

Campbell-Kelly, Martin. *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry.* Cambridge, MA: MIT Press, 2003.

Casper, Monica J., and Adele E. Clark. "Making the Pap Smear into the 'Right Tool' for the Job: Cervical Cancer Screening in the USA, circa 1940-95." *Social Studies of Science* 28, no.2 (1998): 255-290.

Ceruzzi, Paul. *A History of Modern Computing.* 2nd ed. Cambridge, MA: MIT Press, 2003.

Connell, Bettye Rose, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story, and Gregg Vanderheiden. *The Principles of Universal Design.* Raleigh: North Carolina State University, Center for Universal Design, 1997. http://www.ncsu.edu/www/ncsu/design/sod5/cud/about_ud/udprinciplestext.htm.

Cooke, Annemarie. "A History of Accessibility at IBM." *Access World* 5 no.2 (March, 2004). Accessed August 29, 2012. http://www.afb.org/afbpress/pub.asp?DocID=aw050207.

Covington, George A., and Bruce Hannah. *Access by Design.* New York: Van Nostrand Reinhold, 1997.

Davis, Lennard J. *Enforcing Normalcy: Disability, Deafness, and the Body.* New York: Verso, 1995.

Delgado, Alvaro. "Computers + disabled = hope." *West County Times,* May 22, 1986, 1B.

Dorn, Michael L. "Beyond Nomadism: The Travel Narratives of a 'Cripple.'" In *Places Through the Body*, edited by Heidi J. Nast and Steve Pile, 136-152. London: Routledge, 2005.

Downey, Gregory J. *Closed Captioning: Subtitling, Stenography, and the Digital Convergence of Text with Television.* Baltimore, MD: Johns Hopkins University Press, 2008.

Du Preez, Amanda. *Gendered Bodies and New Technologies: Rethinking Embodiment in a Cyber-era*. Newcastle upon Tyne: Cambridge Scholars Publishing, 2009.

Edwards, Paul. *The Closed World: Computers and the Politics of Discourse in Cold War America.* Cambridge, MA: MIT Press, 1996.

Ellis, Katie, and Mike Kent. *Disability and New Media.* New York: Routledge, 2011.

Ensmenger, Nathan. *The Computer Boys Take Over: Computer, Programmers, and the Politics of Technical Expertise.* Cambridge, MA: MIT Press, 2010.

Epstein, Steven. *Impure Science: AIDS, Activism, and the Politics of Knowledge.* Berkeley, CA: University of California Press, 1996.

Ferrell, Jane. "Computers help the disabled get an equal chance." *San Francisco*

Examiner, March 24, 1985, D3.

Fischer, Claude S. *America Calling: A Social History of the Telephone to 1940*. Berkeley, CA: University of California Press, 1992.

Freiberger, Paul, and Michael Swaine. *Fire in the Valley: The Making of the Personal Computer, Second Edition*. New York: McGraw-Hill, 2000.

Ginnerup, Søren. *Achieving Full Participation Through Universal Design.* Strasbourg: Council of Europe Publishing, 2009.

Gleeson, Brendan. "A Place on Earth: Technology, Space, and Disability," *Journal of Urban Technology* 5, no.1 (1998): 87-109.

Goggin, Gerard, and Christopher Newell. *Digital Disability: The Social Construction of Disability in New Media*. Lanham, MD: Rowman & Littlefield Publishers, Inc., 2003.

Hull, Kent. *The Rights of Physically Disabled People.* New York: Avon Books, 1979.

IBM. "IBM's focus on accessibility," 2008. Accessed August 11, 2012. http://www-03.ibm.com/able/product_accessibility/ibmcommitment.html.

IBM. "Think: A History of Progress: 1890s to 2001," 2008. Accessed August 11, 2012. http://www-03.ibm.com/ibm/history/interactive/ibm_history.pdf.

Kenny, Jack. "Bridging the sensory divide." *TES Magazine. (*Oct. 16, 1998). Accessed 11/2010. http://www.tes.co.uk/article.aspx?storycode=79600.

Knorr-Cetina, Karin. *The Manufacture of Knowledge: An Essay on the Constructivist and Contextual Nature of Science.* Oxford: Pergamon Press, 1981.

Kelty, Christopher M. *Two Bits: The Cultural Significance of Free Software*. Durham, NC: Duke University Press, 2008.

Kudlick, Catherine. "The Blind Man's Harley: White Canes and Gender Identity in Modern America." *Signs: Journal of Women in Culture and Society* 30, no. 2 (2005): 1589-1606.

Latour, Bruno, and Steve Woolgar. *Laboratory Life: The Construction of Scientific Facts.* Princeton, NJ: Princeton University Press, 1986.

Lazar, Jonathan, ed. *Universal Usability: Designing Computer Interfaces for Diverse User Populations.* Chichester, West Sussex: John Wiley & Sons, Ltd., 2007.

Lazzaro, Joseph J. *Adapting PCs for Disabilities.* Reading, MA: Addison-Wesley Publishing, 1996.

Levy, Steven. *Insanely Great: The Life and Times of Macintosh, the Computer That Changed Everything.* New York: Penguin Books, 1994.

Liachowitz, Claire H. *Disability as a Social Construct: Legislative Roots.* Philadelphia: University of Pennsylvania Press, 1988.

Linzmayer, Owen W. *Apple Confidential 2.0: The Definitive History of the World's Most Colorful Company*. San Francisco: No Starch Press, 2004.

Oliver, Michael. *Understanding Disability: From Theory to Practice*. New York: St. Martin's Press, 1996.

Ott, Katherine, David Serlin, and Stephen Mihm, eds. *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*. New York: New York University Press, 2002

Oudshoorn, Nelly, and Trevor Pinch, eds. *How Users Matter: The Co-Construction of Users and Technology*. Cambridge, MA: MIT Press, 2003.

Pugh, Emerson W. *Building IBM: Shaping an Industry and Its Technology*. Cambridge, MA: MIT Press, 1995

Roulstone, Alan. *Enabling Technology: Disabled People, Work, and New Technology*. Philadelphia: Open University Press, 1998.

Sanford, Jon A. *Universal Design as a Rehabilitation Strategy.* New York: Springer Publishing Company, 2012.

Sanford, Jon A. and Bettye Rose Connell. "Accessible Seating in Stadiums and Arenas." *Journal of Urban Technology* 5, no.1 (1998): 65-86.

Schweik, Susan M. *The Ugly Laws: Disability in Public*. New York: New York University Press, 2009.

Scotch, Richard K. *From Good Will to Civil Rights: Transforming Federal Disability Policy.* Philadelphia: Temple University Press, 1984.

Scott-Webber, Lennie, and Anna Marshall-Baker. "Two Contrasting Approaches to Urban Accessibility for Individuals with Disabilities or Special Needs." *Journal of Urban Technology* 5, no.1 (1998): 1-15.

Serlin, David Harley. *Replaceable You: Engineering the Body in Postwar America*. Chicago: University of Chicago Press, 2004.

Shapiro, Joseph P. *No Pity: People with Disabilities Forging a New Civil Rights Movement.* New York: Three Rivers Press, 1994.

Spechler, Jay W. *Reasonable Accommodation: Profitable Compliance with the Americans with Disabilities Act*. Delray Beach, FL: St. Lucie Press, 1996.

Suchman, Lucy. *Human-Machine Reconfigurations: Plans and Situated Actions, 2nd Edition*. New York: Cambridge University Press, 2007.

Turner, Fred. *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism*. Chicago: The University of Chicago Press, 2006.

Wilkoff, William L., and Laura W. Abed. *Practicing Universal Design: An Interpretation of the ADA.* New York: Van Nostrand Reinhold, 1994.

Woolgar, Steve. "Configuring the User: The Case of Usability Trials." In *A Sociology of Monsters: Essays on Power, Technology and Domination*, edited by John Law, 57-99. London: Routledge, 1991.

Yost, Jeffrey R. *The Computer Industry*. Westport, CT: Greenwood Press, 2005.