Augmentative, Alternative, and Assistive: Reimagining the History of Mobile Computing and Disability

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"New machines give the silent a chance to speak," read the headline of an article in *Newsday* profiling the Nassau United Cerebral Palsy Treatment and Rehabilitation Center in Roosevelt, New York. The center was training disabled individuals to use computerized communication aids, specifically adults and children who were unable to speak or had minimal speech due to developmental or acquired impairments. Said Salvatore Gullo, the center's executive director, "With the development of all this new electronic technology, it became apparent that there were more ways to get nonverbal people to communicate and put them in more contact with their environment, with their families and their peers."[1] Another article in the *Wall Street Journal* echoed that hopeful sentiment. It profiled a Long Island man who created a charity to provide pricey communication technologies to nonspeaking autistic children. "It's amazing how difficult life is when you can't communicate," he was quoted as saying, "and this gives them a voice."[2]

The two articles speak volumes about the rhetoric of revolution embraced by technophiles in the digital age,[3] the discourse of technology as an equalizer of access and opportunity for individuals with disabilities,[4] and the notion of "voice" as both symbolizing human speech and serving as a powerful metaphor for agency and self-representation.[5] Each piece sings the praises of consumer electronics companies (Texas Instruments and Apple, respectively) and their mobile communication products with speech output capabilities (the TI Vocaid and the Apple iPad).

However, despite common themes and almost interchangeable quotes, the two pieces were published nearly 30 years apart, in 1983 and 2011. This article explores the linked histories and sociocultural implications of the Vocaid and the iPad. Through this brief case study, I argue that developments in mobile computing and advancements in electronic communication aids for nonspeaking individuals are inherently intertwined through the history of their research, development, commercialization, use, and reuse. Although disability is often underrepresented in the history of computing,[6] it has played, and continues to play, a significant role in how computers augment and provide alternatives to human communication and expression.

Augmenting Mobile Communication History

Many nonspeaking individuals use technologies commonly referred to as augmentative and alternative communication (AAC) devices to augment other forms of communication (such as nonverbal gestures and nonlexical sounds such as laughter) and as an alternative to oral speech.[7] AAC devices range from low-tech (picture cards and plastic communication boards) to high-tech versions (computers like those used most famously by physicist Stephen Hawking and film critic Roger Ebert). Electronic AAC systems provide individuals with significant expressive language impairments (due to disabilities such as autism, cerebral palsy, and traumatic brain injury) with tools for selecting words, symbols, and images to communicate their thoughts and converse with others through digitized and/or synthetic speech.

Prior to microcomputers, electronic AAC devices tended to be stationary and custom built at a cost of $15,000 to $50,000.[8] Early electric communication aids took the form of special systems to control typewriters through alternative inputs (such as a straw that sends signals to a device through inhales and exhales).[8] Priced at $2,000, the Phonic Ear HandiVoice, developed in 1978, was the first portable commercial voice output communication aid.[9] It came in two versions: one with a keyboard for words, pictures, and symbols and another with a calculator-like keyboard that required users to learn hundreds of three-digit codes in order to speak a single word.[10] Contrary to its name, the four-pound HandiVoice was not easily handheld; rather, "saying something with this device was like chiseling words into a stone tablet," noted one user.[11]

Canon and TI were motivated to enter the assistive communication aids market in the late 1970s and early 1980s because of their advancements in microelectronics. US legislation such as the Rehabilitation Act of 1973 and Education for All Handicapped Children Act in 1975, which would purportedly fund such assistive technologies, also incentivized the companies.[12] In 1977, Canon introduced the Canon Communicator, a portable tape typewriter "for non-oral, motor impaired persons."[13] The Communicator was included in a 1980 national print newspaper advertisement commemorating the

company's 25th anniversary alongside other Canon products such as the SureShot automatic camera and PalmPrinter calculator. "In addition to general consumer items," the ad explained, "Canon's optic, electronic and engineering capabilities contribute to industrial productivity, as well as professional and humanitarian aims."[13] Technical, economic, and social factors all contributed in part to the production and distribution of the Communicator.

Similarly, TI explicitly marketed the Vocaid as a dedicated AAC device and as a member of the company's product family. The Vocaid Owner's Manual links the communication aid to TI's corporate lore, noting that "Texas Instruments invented the integrated circuit, the microprocessor, and the microcomputer, which have made TI synonymous with reliability, affordability and compactness. Vocaid carries on TI's tradition of technology leadership."[14] Launched in 1982, the Vocaid was a direct spinoff of a preexisting TI product, the Touch & Tell toy, introduced a year earlier. In both products, printed interchangeable panels overlaid a touch pad that, when pressed, activated an electronic circuit to verbally pronounce sounds, letters, numbers, words, and phrases. A 1983 report from the US Congress' Office of Technology Assessment noted that the Vocaid "might well have never been modified and commercialized had Texas Instruments not already had a running start on this technology."

The Touch & Tell was based on TI's prior innovations in synthetic speech and solid-state memory. In 1978, the TI Speak & Spell toy became the first consumer electronic device to duplicate the human vocal tract on a single chip of silicon.[15] The aforementioned *Newsday* article highlighted this repurposing, noting of the Vocaid, "Now, the same technology that produced the little child's toy that E.T. the extra-terrestrial rearranged to 'phone home' with is also being used to give non-verbal people a new way to find a voice."[1] Interestingly, it is the Speak & Spell's own reinvention in the 1982 film E.T. that catapulted it into the cultural zeitgeist.[16]

Ultimately, the Vocaid was, by most accounts, a failure. Former Vocaid engineer Paul Michaelis commented, "It just sat on the shelves. It was a tremendous disappointment…. Nobody bought it."[17] While the Touch & Tell sold for approximately $40, the Vocaid was priced much higher at $150,

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beyond most individual's means.[1] Various policy and economic disincentives led to the Vocaid's eventual discontinuance, including delayed and partial reimbursement from third-party funders such as Medicare, high marketing costs, and difficulties in identifying prospective users because of the diverse range of disabilities that manifest in an inability to talk.[12] Arlene Kraat, director of the CUNY-Queens College Augmentative Communication Center, noted her frustration over barriers to full utilization. Devices like the Vocaid were "capable of a lot," she said, "but we just can't get it to the people who need it. There's a lot of money to develop talking cars, talking toys and talking refrigerators because there's a better profit in it."[1]

Recovering Disability

Repurposing, such as that of the Speak & Spell, Touch & Tell, and Vocaid, has a long history. Various historians of communication technologies have chronicled how moments of "progress" and "innovation" always enter into preexisting systems[18] and how technological "failures" produce new forms of knowledge.[19] Media studies scholars Jay Bolter and Richard Grusin use the term "remediation" to describe the refashioning of new media out of prior media forms.[20] With respect to the history of assistive devices, Mara Mills has written, for example, about how throughout the 20th century, AT&T and Bell Labs drew on notions of "normal" hearing to develop telephone technologies and then transformed telephone parts into components for hearing aids and audiometers to measure hearing loss.[21] At the dawn of the PC era, AAC devices remediated advancements in microcomputing, and the Vocaid was later appropriated by hackers and hobbyists engaged in the art of circuit bending (the

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creative rewiring of electronic devices and toys to create new and unusual sounds.)[22]

The iPad, as an AAC device, also remediates the Vocaid and the Touch & Tell. Instead of printed panels, the iPad supports various apps. The tablet can be an assistive technology, a videogame console, and myriad other tools. However, the iPad, when used for AAC, also carries with it the legacy of struggles over private and public funding for assistive technologies. Although most apps available in iTunes are free or cheap, AAC apps are some of the most expensive in the Apple marketplace, costing $200 to $300. Meanwhile, state agencies and insurance companies generally do not cover the iPad (which currently sells for $299 to $929) because it is not considered "durable medical equipment," meaning a technology exclusively dedicated to AAC.[23]

The comparative case study of the Vocaid and the iPad illustrates how the research, development, commercialization, use, and reuse of augmentative and alternative communication devices is embedded within the history of mobile computing. The Vocaid, Touch & Tell, and Speak & Spell not only carry on "TI's tradition of technology" but also join devices such as portable televisions and radios in an extended lineage of mobile communication technologies.[24] Moreover, the history of AAC sheds light on the inexorable, but understudied links between the history of communication technologies and disability history. Disability and impairment are not simply addressed by rehabilitation and recovery through assistive technology; individuals with various disabilities need to be recovered from and rewritten into the history of how communication technologies are designed, marketed, and adopted. While "new machines give the silent a chance to speak," the history of communication technology should listen more closely to the economic, social, and cultural logics that whisper through today's speaking machines.

References and Notes

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