Deaf-led alarm design: technology and disability in home, work and parenthood

Gretchen Von Koenig

History of Capitalism, Technology and Culture, University of Delaware College of Arts & Sciences, Jersey City, New Jersey, USA

Correspondence to
Gretchen Von Koenig;
gvk@udel.edu

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ABSTRACT

Domestic alarms are highly personal technological appendages that help us achieve an individual sense of safety and familial well-being—like baby monitors that help us care for children and alarm clocks that ensure a daily routine and help us get to work on time. Alarms can be understood as technologies that extend our eyes, ears, and memory to monitor our homes and ourselves in various ways beyond typical human capacity. The designs of domestic alarms tend to favour audible forms of alerting, and disabled users and inventors have hacked and redesigned alarms to fit their own families' needs. Alarm design can tell us what type of domestic futures designers and technologists have imagined, casting visions about who is fit for parenthood and who is a reliable worker, and what types of futures disabled users imagined for themselves. As the future of these technologies becomes subsumed into smartphones and other IoT devices, a look into their predigital material forms uncovers episodes of disability agencies that assert a right to disability futures of domestic bliss and safety. Through the archives of The Deaf American and other deaf community publications, this research reviews the postwar alarm designs of Emerson Romero, a Cuban-American deaf activist and engineer, to show how deaf-led alarm designs are forms of material rhetoric that assert a right to a domestic future for disabled parents and workers.

INTRODUCTION

Doorbells, alarm clocks, baby monitors, kitchen timers, fire and burglar alarms are everyday technologies that help us wake up, care for our families, get to work and feel safe. Domestic alarms are highly personal technological appendages that help us achieve an individual sense of safety and familial well-being—such as childcare through objects like baby monitors and alarm clocks that ensure a daily routine to get to work on time. Alarms can be understood as technologies that extend our eyes, ears and memory to monitor our homes in various ways beyond typical human capacity. Alarm design can tell designers' and technologists' imagined futures, inlcuding who is considered fit for parenthood and the workplace, and what types of futures disabled users imagined for themselves.

Mid-century alarm clocks and baby monitors were predominantly designed as sound-based consumer technologies that left deaf home dwellers disenfranchised as workers and parents—casting a future of idealised workers and parents rooted in ableist assumptions and rooting the normative nuclear family's future as a hearing family (Kafer 2013, 69). Archival resources show that disabled users and inventors pushed back and redesigned alarms to fit their own families' needs, casting a vision for deaf futures that achieve domestic bliss and safety. As the future of alarm technologies become subsumed into smartphones and other Internet of Things (IoT) devices, a look into their predigital designs—physical products present in a household's visual and material landscape—uncovers episodes of disability agency in material form. Through the archives of The Deaf American and other deaf community publications, this research reviews the postwar alarm clock and baby monitor designs of Emerson Romero, a Cuban-American deaf activist and engineer, to show how deaf-led alarm designs are a form of material rhetoric that claim a right to a domestic future for disabled workers and parents.

As many disability scholars have noted, digital and physical technologies can produce disability through their material configurations and elected functional qualities, particularly if the technologies become essential to modern life (Ellcessor 2016, 94; Guffey 2018; Hamraie 2017). Specifically within deaf technologies, Jaipreet Virdi has argued that mid-century commercial deaf technologies in the USA were often marketed with ableist rhetoric, including pressuring deaf mothers to purchase hearing aids in order to 'properly' take care of their children (Virdi (2020b), 207–211). Judgements of parental fitness thus became tied to the use of domestic equipment, and similarly, notions of 'good parenting' became tied to use of baby monitors (Virdi (2020b), 207–211; Nielsen 2014, 309). Alarm clocks are another piece of domestic equipment that ensures a family sticks to a routine, and is the first assistive device in a worker's day. Alarm clocks and baby monitors are considered essential to modern domestic life for parenting and working–but both relied heavily on auditory alerting systems. Domestic alarm technologies thus were designed around an able-bodied ideal, and deaf people had to find ways to be included in them in order to be considered as 'normal' and 'successful' workers and parents (Jones 2017, 4; Virdi (2020b), 200).

Deaf people began to tinker and 'hack' these technologies and their electrical configurations to be alerted through vibrations or lighting alerts, translating sound-based systems into felt or seen systems. And companies caught on during the mid-twentieth century as some began to integrate vibrational and light-based technologies into their product lines, but with poor results. They often did not consider how the objects materially lived functionally and symbolically in deaf households—at best not working for disabled people and at worst

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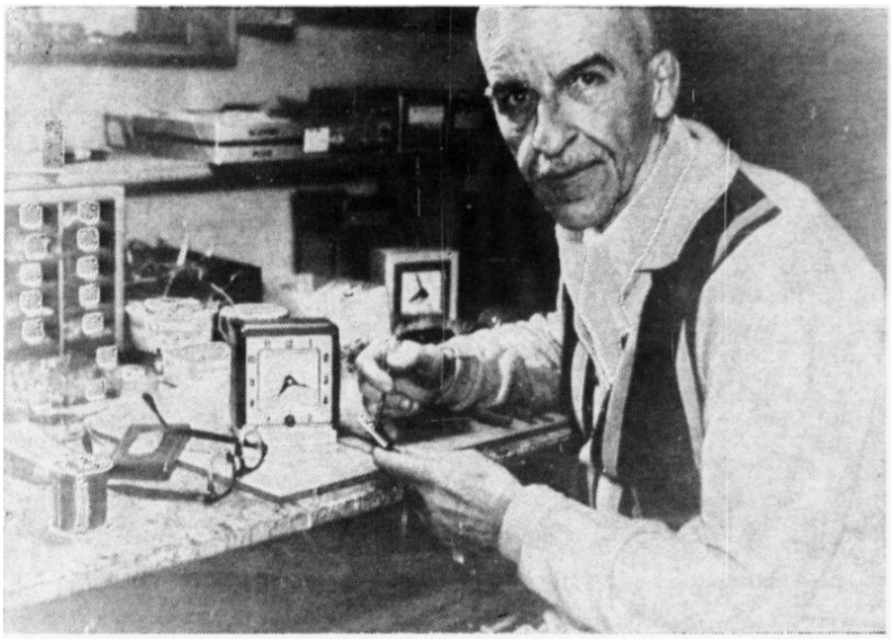

Figure 1 Picture of Emerson Romero from an article by Dorene Romero, 'That's My Pop!' in *The Deaf American*, Vol. 17 No. 11 (adapted from Romero 1965). Courtesy of the Gallaudet University Archives.

causing physical harm through faulty equipment that caused burns or electric shocks.

Cuban-American Emerson Romero (1900–1970) was a deaf activist, engineer and father who worked endlessly to imagine a new future for deaf parents and workers through alarm design and innovation (figure 1). He is most famous for his innovation and advocacy for film captioning, stemming from his early career as a successful silent film actor who was frustrated that deaf audiences became disenfranchised when the film industry transitioned away from silent films to sound-based films (Romero 1951; Virdi (2020a). Lesser known was his business *Vibralarm*, which made and retrofitted alarms for deaf people (Hayer 1968, 566–567; Rosenholtz and Strum 1972, 7–10). Romero's intervention into alarm technology is a case study for how disabled users adopt, reject and alter objects when mainstream invention casts disabled people out of normative work and family structures and their attendant material systems (Hamraie 2017, 12; Costanza-Chock 2020; Ott *et al* 2002; Oudshoorn and Pinch 2005).

As a cultural force, technologies can implicitly cast a vision of eradicating disability as the natural and obvious foundation for technological development, circumscribing technology's value as the elimination of disability (Kafer 2013, 3–20). While this is evident in medical technologies such as reproductive screening tests for disability in fetuses, everyday technology in our material landscapes is also couched in ableist assumptions about what constitutes a better future that supports a compulsory ableist worldview (Kafer 2013, 70–84). Disabled people negotiate such assumptions in the human-made environment through a variety of material-based acts (Ott *et al* 2002), what Arseli Dokumacı calls 'activist affordances': invisible acts of worldmaking that don't announce themselves as activism, art or design—but as 'art/acts of getting by' (Dokumaci 2023, 3–14).

A speculative and cultural practice, designing alarm technologies can implicitly advocate for inclusive visions of the future for disabled parents and workers—a 'hopeful' practice that Romero (and many other disabled people) tinkered with in everyday objects that did the work of inclusion for deaf people (Costanza-Chock 2020, 15; Williamson 2019). Williamson and Guffey's 'design model' identifies disability as a phenomenon that can be ameliorated through digital or material things and can be enacted by designers, users or anyone suggesting a material change. Unlike the medical model, the design model does not imagine 'curing' as the only future state for disability, but instead delivers agency to 'artefacts by imagining that objects and spaces can do the work of inclusion' (Williamson and Guffey 2020, 6). Using the design model of disability, this paper asserts that Romero's alarm designs can be seen as a form of material rhetoric that assert a right to a domestic future for disabled parents and workers, and make real the conditions necessary for deaf domesticity in modern culture (Williamson and Guffey 2020).

Romero used design acts to build activist affordances from his own experiences, tinkering to make alarms available, useful and desirable by deaf people. His interventions into alarm design were not only limited to correcting functional limitations of alarms for deaf people—but extended into aesthetic and sensorial qualities of product design that asserted a vision for deaf home dwellers to have the right to live beautifully and comfortably within their homes. Romero changes aspects of external materials, internal mechanisms and interface design to be more aligned with the specific needs and activities of deaf families in their domestic lives. Specifically, Romero's designs changed deaf alarm design in two important ways: First, his designs moved away from products that look like electrical equipment meant to be hidden within a domestic landscape, to aesthetically considered objects meant to be seen. Moving away from what Virdi criticises as 'design-as-discretion' (design tactics that stigmatise deafness as something to hide), Romero's attention to aesthetics made deaf identities and expression visible in their domestic landscapes; and second, his designs moved away from faulty and unreliable equipment that burned deaf users to carefully calibrated vibrational units to deliver alerting signals safely, a form of what has been labelled 'criptechnoscience' (Hamraie and Fritsch 2019). He achieved both of these design values through an iterative and community-led approach, where Vibralarm products were in constant

state of upgrades guided by collaboration and consultation with his deaf community.

EARLY ALARMS: HIDDEN DESIGNS AND THREATENING MATERIALITY

In decades prior to Emerson Romero's entry into the deaf alarm space, publications such as *The Deaf American* and *The British Deaf Times* advertised and reviewed alarms for deaf people. These alarms used transistor-enabled technology that translated environmental circumstances–such as doorbells, baby cries or a room's temperature–into light-based or vibration-based signalling systems instead of auditory-based ones. As early as 1932, *The British Deaf Times* reported on a 'Novel Fire Alarm' used in a deaf institution where 'watchmen' could 'set all the mattresses on all the beds shaking' in case of a fire, or any other danger (*The British Deaf Times* 1932, 1936).

The alarms that were sold in publications for the deaf community through the 1930s and the 1950s were primarily electrical kits consisting of connector cords and a specially designed outlet that allowed people to link up alarms to existing lamps within a house, so that when an auditory alarm went off, a lamp would flash to alert deaf users. The 'Sordoviso Silent Bell System' in The British Deaf Times (1936) and Visabell in US-based *The Silent Worker* (1949) were two such products. The Visabell was an electrical outlet that connected doorbells to lamps, and was actually produced and sold by *The Silent Worker* itself. While they also sold pins and membership directories, the Visabell seems to be the only technology the *Silent Worker* (later renamed *The Deaf Americ*an) sold, not only suggesting a dearth in the marketplace of alarm technologies for deaf Americans in the mid-century, but also suggesting that the deaf community valued and used community-hosted approaches to disability technology development. After a few months of sales, however, the publication announced in October of 1950 that they could no longer sell the unit due to rising manufacturing costs, further suggesting that affordability was a priority of the deaf community in their approach to design and technology. Understood through the design model of disability, products like Visabell show how disability community approaches to technological development are guided by values of community and affordability not found in medical or for-profit enterprise spaces of production.

Also advertised in the 1950s was Electro Vision Laboratory's (EVL's) 'Baby Cry Relay', a baby monitor for deaf parents (figure 2). The baby monitor used microphones to pick up a baby's cry, and translated the auditory cries, through wires and outlets, to flashing lamps around the house, or set off a vibrational pad that could be placed under a seat or pillow (*The Silent Worker*, January 1951 to May 1952; Oct 1952 to March 1953). EVL, like Visabell, primarily sold technical equipment, such as outlets, that linked to other home products to produce the appropriate alerting signals to deaf parents. By the early 1950s, there were several companies advertising domestic alarms in the pages of *The Silent Worker* including Heller Instruments, which advertised wireless baby cry relays, fire alarms and burglar alarm kits (April 1953 to December 1971); and Sonotrol, who sold 'compact, all transistor' fire and baby alarm systems that could be discretely integrated to many different lights throughout a house (September 1961 to March 1970).

Most of these products were limited to an outlet with cord attachments that were meant to be placed underneath pillows or behind furniture. In one way, these early kits of electrical components that connected existing lamps to alarms made for a hearing population speak to the tinkering and DIY aspects of the disability material culture. 'Hacks' were and continue to be part of how people with disabilities fit into the man-made world, and publications like the postwar Toomwy Gazette even featured

Figure 2 Advertisement for Electro Vision Laboratories 'Baby Cry Relay', in *The Silent Worker* Vol. 03 No. 07 (January 1951). Courtesy of the Gallaudet University Archives.

'hacks' to alter mass produced products, showing the technological efforts that disabled people made to fit into the spaces of postwar life (Williamson 2019, 65–71). This produced forms of access that retained a 'spirit of local knowledge and do-it-yourself technical work', as an aspect that one could interpret as a leading factor into why these early alarms were more 'hacked' into a home invisibly (Williamson 2019). These companies advertising these alarms rarely included images of their products in their consumer electronic advertisements, presumably because their physical design was driven by 'compact' forms of technical equipment that was meant to be hidden in the home rather than displayed (figure 2).

However, hidden technologies for disabled identities also recalls critiques about 'secretive' approaches to design for disability that carries stigmatising forces. Design-as-discretion selling points stigmatise deafness as something to hide in order to fit in with a 'normal' hearing population, implicitly conveying the ableist assumption that deaf people want 'to disguise their impairment'—as Jaipreet Virdi in her essay analysing hearing aid critiques elsewhere in this issue. In twentieth-century Anglo-American society, there was a growing distaste for visible signs of physical impairment within 'polite society' (Jones 2017, 10). Specifically, secretive and hidden designs for disabled people prevailed uniquely in US capitalism as a design culture: hidden design strategies of blended curb cuts contrast drastically to welfare-oriented cultures that visibly assert disability visibility in the built environment, such as Britain's postwar accessible toilets and special road vehicles that visibly asserted disabled identities in the built environment (Guffey 2020b, 109; Guffey 2018, 69–89). Within deaf cultures, Jaipreet Virdi further historicises that hearing aid advertisements boasted discreteness and compactness as a design feature, trying to sell a lifestyle that would allow deaf people to lead 'normal, successful lives' (Virdi 2020b, 200–207).

This effect of secretive design culture also affected alarm design, particularly when compared with baby monitors for hearing parents. Hearing parents were offered electric baby monitors that aesthetically celebrated electronic monitoring equipment for parenthood. As early as 1938, Zenith sold the *Radio Nurse* designed by the Japanese designer Isamu Noguchi (figure 3). The monitor consisted of two parts—a 'guardian ear' to be placed near a crib and a sculptural 'radio nurse' receiver

Figure 3 'Instructions for 'Zenith Radio Nurse' Baby Monitor' 1938. Image from the Collections of The Henry Ford. 2004.10.2. Zenith Corporation (1938).

(shaped like a surrogate nurse's head) to be placed near the parents (Noguchi n.d; Zenith Corporation 1938). The Radio Nurse was advertised as not only innovative parenting technology that brought 'the nursery into the living room' but also—as the advertising art direction suggests—a beautiful object that could exist on decorative shelving alongside animal sculptures and flower vases (Zenith Corporation 1938). But the outlet and hidden-away approach of baby alarms for deaf parents looked like technical equipment that visually aligned more with a factory or an engineering department than a home (Fallon 2020). Whereas hearing parents were offered products that signalled good parenting through sculptural home goods, deaf parents were mostly offered what looked like technical equipment to be hidden away—denying them material expression of parenthood offered to hearing parents.

The display of material artefacts inside the home matters for identity construction. The craft of 'giving objects house room' asserts a family's domestic identity (Grier 1997; Parr 1999): As objects become domesticated, they enter a complex sign-system that signals a 'households moral economy'—materially showing what a family values are, such as safety or cleanliness (Oudshoorn and Pinch 2005, 14). Therefore, household objects carry associations with them that express identities within a domestic visual landscape. As Jaipreet Virdi argues elsewhere in this special issue, deaf technologies that focus on invisibility can be 'challenging for identity construction' and hidden alarm technologies denied deaf parents the opportunity to display their identities and values as parents in their domestic environment (Virdi 2024). By extension, these technologies assert a future where hearing parents are valued more in symbolic domestic landscapes than disabled parents were.

In addition to hidden aesthetics, these technologies also posed physical threats to deaf users. While the alarm clock industry tried to expand alarm clock sales into deaf markets, their designs were not a holistic approach to alarm design for deaf people, but instead were merely an insertion of a more extensive vibrating function into an alarm designed to be audibly heard. This resulted in faulty and overheated devices that 'scorched' bed linens and bodies of deaf children and adults. This was not unique to alarms; other mid-century companies that parroted so-called 'advancements' in transistor-enabled hearing aids actually caused more headaches than hearing, prioritising commercial profit over deaf-user experience (Virdi 2020b, 31). Historically, deaf users of 'new' technologies often bear the brunt of malfunctions with their own bodies, and alarms caused burns on deaf users' heads and shoulders—a form of what Graham Pullin calls 'design against disability' (Pullin 2009, 2) and what Amie Hamraie has described as a site of 'frictioned negotiation of access' (Hamraie 2017).

Not only causing physical pain, alarm clocks and baby monitors that hurt or did not work for deaf users also caused reputational harm to deaf families as unfit for parenthood or as unreliable workers. The trend of developing technology first for an able-bodied population, and then subsequently retrofitting them for disabled needs, induces a 'cultural lag' for disability participation (Ellcessor 2016). This process has the potential to portray disabled people as technologically inept or as 'shut-ins'—when in reality disabled people have been cast out of the technology (Ellcessor 2016; Williamson 2019, 12). Sarah Rose further explains that this 'lag' is one source of the stereotype of disabled people being 'lazy', critiquing it as a construct of industrial capitalism's wage labour system that relied on a normative body population—defining the disabled body as unfit for work (Rose 2017). Alarms that cast disabled people out of their function create the assumptions around who deserves care and protection and who is meant to feel safe, as they are material artefacts that mediate emergency and constitute actual perceptions and feelings of safety through their presence and use—part of a home's 'infrastructure of feelings' (Ellcessor 2022, 34–35). Alarms codify values about who or what is worth alerting about and whose emergencies matter. These early models of deaf alarm clocks and baby monitors were forms of disability exclusion in how they literally and symbolically functioned: casting, or burning, deaf users out of a technology all working people relied on and denying deaf parents domestic security of child safety and opportunities to symbolically express their parenthood.

CASTING NEW FUTURES FOR DEAF PARENTS AND WORKERS: EMERSON ROMERO'S DESIGNS

Perhaps it was the mixture of threatening, ugly and unavailable technologies that galvanised Emerson 'Em' Romero (1900–1970) to take up alarm clock design when he did in 1961 (figure 1). Romero was a deaf father, activist and actor and had a background in community organising, silent film acting and sheet metal engineering—all of which played a part in how he approached deaf technology design. He was inspired to tackle alarm design a little later in his life, when his deaf friend complained that deaf alarms were prone to 'cracking and chipping' and were 'very sad looking' (Romero 1965, 9). With the help of his deaf community, his designs greatly improved on alarm efficacy for deaf users. Romero changes aspects of external materials, internal mechanisms and interface design to be more aligned with the specific needs and activities of deaf families in their domestic lives.

Before getting into alarm design, Emerson had established himself as a successful silent film actor, a pioneer in deaf technologies and as a political leader in the deaf community by the 1930s. A Cuban-American who immigrated into the USA, Romero initially went to college for engineering but instead pursued a career in silent film acting during the 1910s and 1920s. As the film industry transitioned to 'talkies', he witnessed first-hand how deaf actors and audiences were cast out of film entertainment, and even more detrimentally, deaf school children were no longer able to access educational films (Rosenholtz and Strum 1972, 8; Virdi 2020a. Romero stated that when he tried to petition the film industry to caption films so deaf audiences could continue to enjoy them, he was met with the profit-driven feedback that the market wasn't big enough (Romero, 10).

With a background in engineering, he began to acquire films with his own money and splice captioned screens in between scenes. He paid special attention to how long captions stayed on the screen, to allow children to read at their own pace, as well as ensuring a dark background to the text, rather than overlaying text directly on film, to maximise contrast for visibility and easier reading (Rosenholtz and Strum 1972, 9). The films he made were not for sale, but instead used to start libraries that rented out captioned films to schools and organisations, a programme that grew to be the Captioned Films for the Deaf programme hosted by the federal government (Rosenholtz and Strum 1972, 9). He even testified before Congress on the importance of access measures in film and television (Romero 1951, 22; Virdi 2020a). His work in deaf technologies of closed captioning was rooted firmly in his community activism, galvanised by helping local communities access films of cultural and educational importance.

After leaving the film industry, he went to work using his college training as an engineer as a sheet metal specialist for

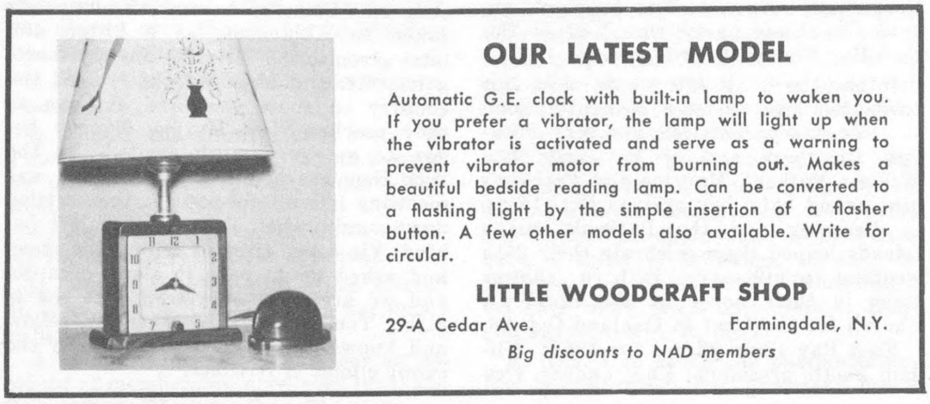

Figure 4 Advertisement for Vibralarm in *The Silent Worker*, Vol. 15 No. 06 (February 1963). Courtesy of the Gallaudet University Archives

fighter jet production at Republic Aviation Corporation in Farmingdale, New York (Hayer 1968, 568). During his 25-year career as a sheet metal template designer and technician, he also continued to be a leader in his local deaf community where he started all sorts of libraries, bridge clubs, theatre guilds and sports leagues, as well as being a very involved member of the National Association of the Deaf as a writer, reporter and editor of *The Deaf American* (Hayer 1968, 10). After working professionally as a sheet metal engineer, and his own exploration of captioning technology, he later turned his engineering skills to improve on technologies that deaf families relied on everyday: alarms and baby monitors.

In an interview with his daughter, Romero stated he was first inspired to improve alarm design in 1959 after one of his friends complained that all the vibrating alarms for deaf users were prone to 'cracking and chipping' and were 'very sad looking'—echoing many deaf users' complaints with the abysmal deaf alarm market that 'scorched' bed linens and bodies alike (Romero 1965, 10; Hayer 1968, 566). Romero designed a solid walnut alarm clock that his friend was very happy with, and soon others called Romero to request their own clocks in maple, walnut and mahogany. He soon started a business: *Little Woodcraft Shop: Vibralarm Service*, a business that made and retrofitted alarms for deaf people, which debuted in the September 1961 issue of *The Deaf American* (Romero 1965, 10).

The original *Vibralarm* clock was a cube-shaped alarm clock with a dark-coloured walnut outer shell and a bright, white internal face with contrasting dark-coloured numbers (figure 1 and figure 4). The numbers are arranged in a squared pattern in a clockwise formation, and the clock face also features tapered clock hands, along with second keepers and inner dots. The clock stands on a base that is slightly larger than its overall cube shape with attached vibrational and lighting elements (figure 4). Advertisements first debuted in the pages of *The Silent Worker* in September 1961 and were immediately identifiable from other deaf alarm companies—he included images of the products themselves, celebrating aesthetics of technology for deaf people, whereas other companies rarely had images of their equipment that was meant to be hidden away. *Vibralarm* advertisements also stressed the mechanical advancements his alarm designs included, addressing the need for alarms for deaf people that did not threaten physical harm.

One of the first design decisions he made was to make his exterior casing to make the alarm clock durable to extensive vibration as well as aesthetically pleasing. He first used solid walnut and later offered models in maple and mahogany. While these were chosen for their aesthetic qualities, Romero also chose them for their durability to withstand long periods of vibrations. Emerson Romero had experience in high-stress material engineering from his time as a sheet metal specialist building fighter jets for the US Army (Romero 1965, 10). The clock face was purchased through Telechron, a subdivision of General Electric, which offered hundreds of models to clock makers such as Romero who fashioned them into his own line of specialty clocks. Given the number of choices in the Telechron lines, the bevelled edge of the dark, mahogany casing paired with the attenuated clock hands suggests that his materials were not chosen for purely functional value, but also their aesthetic expression (Hayer 1968, 566). Romero's bevelled edges are indicative of popular mid-century rounded forms of streamlining, inspired by the aerodynamic forms of mid-century transportation—perhaps also stemming from his work with aeroplane design at Republic Aviation.

He also redesigned the vibrational unit itself. Mainstream buzzer design in other deaf alarms would continue to buzz if not turned off by the user, resulting in physical burns on deaf bodies and their bed linens (Hayer 1968, 566). In an interview, Romero said that the issue to resolve the vibrator overheating came through constant communication with his users who described their frustration that they often forgot to turn it off (Romero 1965, 11). While other manufacturers blamed user error, Romero acknowledged that turning off a buzzer that hearing people constantly heard throughout their environment was easier to remember than turning off a buzzer that deaf peoples' heads were no longer resting on once awake. In his early entrepreneurial days of Vibralarm, he wrote to customers that reported burned out buzzers to ask what happened. They gave numerous reasons as to why the buzzers continuously ran that reflect the daily activities of home life: some forgot to turn off the alarm, some accidentally knocked the buzzer out from under the pillow, and two customers said their 'children played with it and left the buzzer vibrating all day'.

Romero said of his own invention that something must be done to prevent these accidents, putting the onus on his technology rather than the user. He experimented with a built-in lamp that would remain on to serve as a warning that the vibrator was still on (figure 1), but through continued correspondence with his deaf community that used his alarms, it became apparent that the lighting was not enough. He then began working with thermal engineers to design a thermometer that shut the buzzer off after it reached a certain temperature. He explained that the highest temperature the product could withstand was reached after 4 min of vibration, which is when a specially inserted thermostat opens to disrupt the electric circuit and 'stays off for

about 15 minutes. When the buzzer cools off, the thermostat closes and the buzzer vibrates again for about two min. Then off again for another 15 minutes and so on…' (Romero 1965, 10). This innovation meant that the buzzers never burnt out, unlike his competitors. This thermostat was specifically designed for his units, as he explains that 'the thermal engineers who made the thermostats for me had to make them small enough for installation under the cover. Then they had to be calibrated to open at about 165 degrees and close again at 125 degrees' so they were custom to Romero's designs and only worked on his cases (Romero 1965, 10). This approach was very successful, a special design feature he dubbed 'lifetime buzzers', along with a lifetime guarantee of a free replacement, and went as far as to patent the technology (Romero 1965, 10).

While Romero was the catalyst for the thermal approach to buzzer design, he also frequently acknowledged and encouraged feedback from the deaf community in order to improve his products. Romeo's commitment to the iterative process underscores Alison Kafer's statement that assistive device design must always exist as in-process, and not as a 'solution' or 'conclusion' (Kafer 2013). Emerson left many lines of communication open between him and the users of his alarm: he directly wrote to them to solicit feedback, *Vibralarm* advertisements frequently stressed his complaint line and free repair programme, and he often subtitled his ads (a space usually reserved for a tagline of a product) with discount offers to National Association of the Deaf members (the organising body that published *The Deaf American*). Scholars like Claire Jones and Elizabeth Guffey have noted that disabled users frequently provided feedback to device manufacturers, contributing much to the inventions of assistive devices as 'user-designers' who used their experiences to generate better solutions (Guffey 2020a, 159–176; Jones 2017, 11–12; Lieffers 2020). User-designer motivations sometimes encompass humanist motivations over purely economic ones, and understanding the dynamic of disabled user feedback to technological innovation has 'far-reaching implications for how we view the relationship between prostheses and intellectual property' (Jones 2017, 12).

This type of technological design from within the disabled community points to new ways of understanding how commodity culture works for disabled consumers and consumer electronic markets. Typical retelling of postwar 'booms' in US consumer culture often do not track into disabled people's lives—as consumer choice that periodises this era was not offered to equipment for disabled people, where channels of consumption were mainly accessed through medical equipment catalogues with limited options (Williamson 2019, 14–15). Oftentimes, companies deemed disability alterations as 'added flourishes' and denied disabled users aesthetic choices available to able-bodied buyers (Ott *et al* 2002, 8). This forced disabled bodies to design their own variety in standard assistive technology, adding in so-called 'flourishes' by hacking the material world to make disabled goods that fit their bodies and express their personalities. 'Disability commodity culture' was user-led, where the variety offered to able-bodied consumer sectors was generated by disabled users, who made their own variety by producing their own specialised cutlery, hearing trumpets, amplified telephones and replacement body parts (Jones 2017, 18).

Romero offered additional models and styles of alarm clocks and baby monitors signalling his commitment to offering a variety of aesthetic styles available to deaf parents in order to achieve individual expression inside their homes according to their own taste, values and income (figure 5) . An advertisement from 1963 shows that he not only featured photos of his alarms, but also took copy space to detail other finishes, functions and alterations available to his product line (figure 5). *Vibralarm*'s product line underscores that access in disability technology cannot be reduced or flattened, but is inseparable from the 'intensity of human variation that gives it purpose' (Ellcessor 2016, 12). Vibralarm's success within the deaf community signals that he did not just engineer a solution to 'overcome' a disability, but understood assistive devices as 'things to live with' that carry aesthetic and functional meaning (Pullin 2009).

Romero constantly re-evaluated disabled technologies for everyday life with the aid, and acknowledgement, of the deaf community's experiences and knowledge. Romero's constant search for improvements, aided by user feedback, reveals a stance of his products as always in-process, rather than a final solution—a quality essential to design for disability as the unending variety of emotional, functional and symbolic goals varies from person to person (Hendren 2020; Kafer 2013). He also sold the vibrating unit separately for $3.39 that allowed individual users to connect it to an alarm clock of their own choosing. Reviewers of the clock celebrated his designs that their 'livelihood depends on' as well as complimented Romero on the 'lovely finishes of the clock case' (Hayer 1968, 568; Rosenholtz and Strum 1972, 9).

In 1965, Romero retired from his 25-year career at Republic Aviation in 1965 to focus solely on *Little Woodcraft Shop: Vibralarm Service*. By 1965, he had sold over 1000 units in all 50 states and internationally in places like Cuba, India and Brazil. The business continued to grow and he had to hire an administrative assistant to handle the volume of business he was receiving. Vibralarm continued to grow reputationally as well, it was a favourite of institutions like the Office of Vocational Rehabilitation and received widespread recognition after a favourable consumer report in the 1968 edition of *The Volta Review*, the journal of the Alexander Graham Bell Association for the Deaf and Hard of Hearing (Hayer 1968, 566–567).

CONCLUSION

Baby monitors and alarm clocks are electronic devices that can enfranchise or disenfranchise users through their alerting functions, helping people achieve domestic security and ensure their daily routines. Romero tinkered and innovated alarms to include deaf users in essential alerting technologies for work and childcare and imagined new disability futures through the technologies of everyday life. His future for deaf technologies was rooted in communal approaches, where technological development was not driven by profit but was determined by the daily activities and needs of his community. His technologies captured desires for futures of a more hospitable home, where alarms worked for deaf families, workers and parents.

As a deaf father and engineer, he relied on these products himself but also relied heavily on other peoples' experiences to determine the design direction of his alarm technology. Emerson Romero's design process points to ways in which the user must enter into the design process in order to make meaningful technology for disabled people. Technology histories that prioritise how companies 'solved' disability problems through 'revolutionary' devices exclude disabled agency in material histories, where everyday people tinker with the built environment and, by extension, tinker with 'the structures of everyday life' (Hamraie 2017, 12; Costanza-Chock 2020; Ott *et al* 2002; Oudshoorn and Pinch 2005). Histories of how people materialise the world around them for survival, comfort, belonging and expression: Romero is a case study on how users' creative capacities are a

AUTOMATIC CLOCKS — VIBRATORS

Specially priced for NAD members and subscribers of The Silent Worker

The Vibralarm. A powerful motor which can be adjusted to a soft, medium or strong vibration. Has metal cover and plastic base. Comes with a 5-foot cord, brown or white. About 2" high and 3½" long. Guaranteed to wake the soundest sleeper. Many of our customers have ordered two of these to have a spare on hand. Low priced at 3.39. Two for 6.50.

The Midget. Our newest model. Only 1½" high and 2¼" long. Potter & Brumfield motor enclosed in a wooden case stained and beautifully lacquered to match your clock in either maple, walnut or mahogany. 5-foot cord and plug. Brown or white. This vibrator, with proper care, should last a lifetime. Price 4.95.

G.E. Clock, Telechron movement in a solid wooden case of our own make . . . maple, walnut or mahogany. 5-foot cord, brown or white. Our most popular item! Only one knob in front to operate. Receptacle in back for plugging in vibrator or lamp. Compact and sturdy; ideal for traveling. Measures only 4½ x 4½ x 2½. Unbreakable case made to last a lifetime. Price 13.50. With Vibralarm, 15.95; with Midget, 17.79.

Sonora Time-O-Matic economy clock. In white plastic with 6-foot cord and plug. Telechron movement, UL approved, luminous hands, automatic "ON" and 'OFF" dials. Size 6¼ x 4¼ x 3. Receptacle in front. Price 10.50. With Vibralarm, 12.50; with Midget, 14.95.

All clocks and vibrators operate on 115 volts, AC, 60 cycles. Prices include postage, handling, insurance and taxes. For prompt delivery send check or money order. Or write for circulars and order blank.

LITTLE WOODCRAFT SHOP

29-A Cedar Ave. Farmingdale, N.Y. 11735

SEPTEMBER, 1963

Figure 5 Advertisement for Vibralarm in *The Deaf American*, Vol. 16 No. 01 (Sep 1963) 18. Courtesy of the Gallaudet University Archives.

cultural source of creative innovation, and further, users' creative capacities have the power to effect real technological change that projects inclusive futures.

As many authors have stressed, the open-endedness of the design process holds potential to generate meaningful material culture for people with disabilities, but only if it is designing with—and not for—the disabled community (Costanza-Chock 2020; DeFalco *et al* 2022; Hendren 2020). Further, disabled-led designs often create the most impact, as material interventions that improve on assistive devices have always been disabled-led, through everyday hacks and solutions to everyday problems (Gissen 2022; Hamraie 2017; Williamson 2019). Romero was a user who lived with and depended on the alarm technology he made, and still welcomed his fellow deaf users into the fold of how to ensure the product was meeting their needs. His recognition of those who helped him address technological shortcomings signal a pride in the unique knowledge generated from being deaf, unlike solutions generated from the medical model that sees deafness is a tragedy to overcome (Virdi 2020b, 28). Romero's work in alarm design asserted a future vision for deaf home dwellers to have the right to live beautifully, safely and comfortably within their homes. Romero received a lifetime achievement award from the New York City Civic Association of the Deaf for outstanding service to the deaf community and one obituary reflected on his legacy by stating that they wished 'more deaf people would do as much for each other as Emerson Romero' (Rosenholtz and Strum 1972, 11).

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ORCID iD
Gretchen Von Koenig http://orcid.org/0009-0008-2722-2152

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