

Reuniting speech-impaired people with their voices: Sound technologies for disability and why they matter for organization studies

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Abstract

This paper proposes an analysis of sound and voice technologies for speech-impaired people as sites of knowledge production about disability. It will focus on the case of Google's project to reunite speech-impaired users with their voices using voice cloning technology, an evolution of speech synthesis which allows for the reconstruction of the sonic and timbric characteristics of an individual person's voice. Addressing both the narratives and representations – which reveal a medical model of disability as an external flaw to be cured through technology – and the material practices and operations enacted by those technologies – which highlight epistemologies of human variation, embodiment and accessibility built into the software – the paper argues that disability as a social construct is co-constituted between those levels. In this regard it proposes a socio-technical model of disability theorization which unites techno-scientific knowledge, cultural values, images of the user, material operations and organizational practices. From this perspective the paper argues that the study of disabilities would benefit from the contribution of organization studies and media studies, in order to reveal the constructedness of disability and able-bodiedness, and the role of media technologies, institutions, and representations in producing and upholding – as well as potentially challenging – such constructions.

1. Introduction

Released in December 2019, the documentary *The Age of A.I.* covered a Google project in voice technologies aiming “to reunite speech-impaired users with their original voice”¹. The tech company worked with former NFL player Tim Shaw, who has lost his ability to speak after being affected by ALS (Amyotrophic lateral sclerosis), a disease in which the neurons that control a person's voluntary muscles die, eventually leading to a total loss of control over one's body. The project's aim, as underlined by the documentary commenter, was “to get his voice back”. Collecting voice recordings from Shaw's interviews on national television, Google employed Artificial Intelligence (specifically *machine learning*) to create a synthetic voice profile that imitates Shaw's way of speaking in a realistic and natural-sounding way (Chen *et al.*, 2019). Through a technology called *voice cloning* or more generally *voice synthesis*, Shaw could type sentences into a computer and have them expressed out loud with a synthesized version of his former voice, that is with the sound of his voice before the disease “took it away from him”. In the documentary we see the former football player, surrounded by his parents and three Google researchers listening to the

¹ <https://deepmind.com/blog/article/Using-WaveNet-technology-to-reunite-speech-impaired-users-with-their-original-voices> (accessed on 30/06/2021); the documentary is available online at the link: https://www.youtube.com/watch?v=V5aZjsWM2wo&ab_channel=YouTubeOriginals (accessed on 20/07/2021).

vocalization of a letter he wrote to his younger self. It's a moment of great emotion, underlined by Shaw's words, expressed with what remains of his own, natural voice: "It has been so long since I've sounded like that. I feel like a missing part was put back in place."

Speech synthesis is already ubiquitous in the media landscape, employed in navigators, Interactive Voice Responses (IVRs) in customer service hotlines, and more recently in virtual assistants such as Siri or Alexa; but it has also been employed by Stephen Hawking since he lost the ability to speak in the '80s due to ALS. The peculiarity of *voice cloning* is that it doesn't sound "generic" as it did with Hawking's synthetic voice, aiming instead to reproduce the features of an embodied and personal voice, the voice of a specific person. This subtle but important passage is indicative of the complex connection between voice technologies and disability: such technologies pursue "naturalness" and "realism" to increase their usability and assistive power, but in so doing they are also setting a specific way of treating disability, both in their way of imagining and representing "users" and their needs, and in their defining what a "normal" voice is, how it should sound and what it should allow its "user" to do.

In this paper I will begin by examining the case of voice technologies for speech-impaired people, investigating sound media as sites of knowledge production about disability. Sound technology is a prominent component of social, cultural, and political change with the potential to allow broader accessibility and greater inclusion for disabled people with voice or hearing-related impairments. Yet it can also lead to new forms of exclusion or of unintentional marginalization, especially if it is uncritically viewed as a source of liberation without regard for certain disabling features at the social and productive level. I argue that this way of considering sound technologies, which can be extended to media in general, is theoretically productive for the implementation of a "social model of disability" (Oliver, 1996; Siebers, 2008; Goggin, 2009) and for challenging the long-standing use and adherence to the mainstream medical model. Nevertheless, the approach proposed in this paper further aims to underline the need for social models to focus on non-discursive and material practices. Such practices constitute the disabling constructed environment populated by media technologies – sharing instances arising from the materialist turn in social sciences, promoted in the fields of Science, Technology and Society (Woolgar, 1991), Actor-Network Theory (Law and Hassard, 1999), feminist material semiotics (Haraway, 1991) and media archeology (Parikka, 2012). In this regard, the paper calls for a collaboration between media studies and organization studies in the framework of disability studies. In enabling communication and interaction for impaired people, voice and sound technologies are central for building *access* and *agency* and therefore transcend their status as media to become organizational structures. The discursive and material ways these technologies imagine, represent and empower their users and the organizing practices they lead to thus produce socio-technical definitions of disability which affect cultural, political and institutional positions towards disability itself. I propose to call this attitude a *socio-technical model* of disability.

In the following sections, I will analyze both the representations of disability which emerge from the narrations of technology (such as the above mentioned documentary) and the socio-material aspects of technological artifacts (such as the data-driven practices and operations employed in sound technologies for speech-impaired people). The analysis will highlight the intertwining of cultural and social ideas about ability and disability embedded in presentations, discourses and representations of voice technology with those built into algorithms, standards and material practices. This investigation will show how the medical modeling of the body, the design of media technologies and the agency built into organizational structures all shape one another and co-produce the socio-technical construct of disability.

Section 2 frames the contemporary debate about disability in organization studies and in media studies, with a particular focus on sound studies, highlighting possible convergences between the fields; Section 3 uses the case study of the cloning of Tim Shaw's voice by Google to reflect upon representations of disability in voice technology and AI, underlining the misleading promises of a pure technological fix typical of medical rhetoric; Section 4 discusses material practices and operations related to voice cloning in light of the metaphor of "giving voice" so often used in mainstream narrations of disability as synonymous with giving "access" and "agency"; the Conclusion is an invitation to read the main findings of the analysis as aspects of a socio-technical model of disability, a framework which calls for enhanced collaboration between organization studies and sound and media studies.

2. The framework: disability, sound studies and organization studies

Disability studies as a social and political movement interested in the lives and knowledge of disabled people as a marginalized group has gained great recognition in the last decades (Barnes, 2004; Siebers, 2008; Ellcessor, Hagood and Kirkpatrick, 2017). Central to this field of studies is the critique of the medical model of disability which considers it as «an individual defect lodged in the person, a defect that must be cured or eliminated if the person is to achieve full capacity as a human being» (Siebers, 2008: 3). Unlike the medical approach, which is individual, rehabilitative and productive (Williams and Mavin, 2012), the emerging field of disability studies considers disability as a *social construct*, in this way de-naturalizing it and promoting a social model of disability which does not aim to cure or avoid disease, but rather to study the social meanings, symbols, and stigmas attached to the concept of disability as a component of identity, and how it relates to enforced systems of exclusion and oppression². According to this view, "disability" is socially created and is distinct from "impairment", which describes the physical attribute. To quote Oliver's (1996: 22) famous claim:

we define impairment as lacking part or all of a limb, or having a defective limb, organ or mechanism of the body; and disability as the disadvantage or restriction of activity caused by a contemporary social organisation which takes little or no account of people who have physical impairments and thus excludes them from participation in the mainstream of social activities.

More recently Tobin Siebers (2008: 3) has implemented this definition, arguing that disability is not an individual defect but «the product of social injustice, one that requires not the cure or elimination of the defective person but significant changes in the social and built environment». This emphasis on "the social and built environment" is at the basis of the dialogue between disability studies and disciplines such as media studies and organization studies in recent years. If disability is constructed through normative assumptions underpinning socially constructed categories of difference, those assumptions are not located only in ideas and discourses, but also built into material artifacts, technologies and organizational structures. Williams and Mavin (2012) argue that, although undertheorized in organization studies, disability is an inherently

² The use of the term "disabled people" instead of the one "people with disabilities" is consistent with the social model and as such I adopt it in this paper. As well explained by Hamraie (2017, p. 280): «"Disabled people" is the preferred usage for many disability activists, who argue that they are disabled by society and claim disability as an identity. "Person-first language," such as "people with disabilities," is often associated with medical and rehabilitative models, which identify personhood as separate from disabled embodiment and experience».

organizational problem, not only because it solicits the adoption of solutions in workplaces and human resources management, but also because it is «hierarchically constructed, reproduced and maintained through organizing processes and practices in ways which center the requirements of some organizational members within normative expectations, while marginalizing the requirements of others» (p. 160). Thus, the meeting of disability studies and organization studies, especially in their critical declination, becomes an opportunity to explore how assumptions of non-disability (or ableism) infuse organizing processes and are maintained as an organizing norm, while organizing is presumed to be neutral (Mumby, 2008). This means focusing on socio-material processes of organizing which include norms, codes, legislations and knowledge, but also architectures, environments, artifacts and technologies (Czarniawska, 2015). As Hamraie (2017) argues, design-knowledge is of central importance, since it reproduces assumptions of able-bodiedness which result in a marginalization of disabled people. Knowledge is inscribed in the design of objects and tools which can provide or deny *access* for certain people, thus becoming inextricably interwoven with operative power. “Access-knowledge” is, on the other hand, a theoretical approach focused on examining the relations of knowledge and power inscribed into the design of objects, architectures and infrastructures which articulate and organize access and agency for people.

Placing artifacts and technologies at the center of issues of disability, this approach to the study of disability has interested scholars in media studies as well (Goggin and Newell, 2003; Ellis and Kent, 2011; Ellcessor, Hagood and Kirkpatrick, 2017). Disability, in fact, is all too often reconstituted and reconfigured in and through new technologies, both at the narrative and at the operational level. As Ellis and Kent argue (2011), new technology can broaden accessibility and inclusion for impaired people through their affordances, but those same affordances can also produce new forms of exclusion and disability. In this regard, Ellcessor, Hagood and Kirkpatrick (2017: 16) argue that: «we need to understand the ways that media and information technologies are intertwined with the standardization and regulation of the human body» and how those processes shape the meaning of ability and disability. In their view, this investigation must consider both meaning and materiality, since ideas are embodied in and shaped by material conditions and human practice, and made endowed with meaning by the discourses that inform them and that they in turn inform. Innovations in media technologies thus raise issues of materiality and embodiment which affect also cultural ideas and meanings: how we interact with buttons, dials, or gaming consoles; how we plug in earbuds or position ourselves toward screens, listening devices or speaking devices; how manufacturers imagine the bodies that will engage with their creations, and so on.

These are also organizational issues, since they concern the way bodies share physical and social space and access services and structures, how they communicate and act, but also how they are regulated through standards built into norms and artifacts. As Brunsson, Rasche and Seidl (2012) argue, standardization is a form of organizing outside formal organizations, since standards are “translated” into concrete practices, which include the design, adoption and use of media technologies. These practices, in turn, can be disabling for certain people and reproduce ableist marginalization within organizing. As noted by Mills and Sterne (2017: 365), «not only do media produce disability through their textual representations of disability, they produce disability through their very operations, their institutional existences, and their policy and juridical dimensions». Therefore, we must take great care with both representations and material operations, ideas and embodied practices, collective images and technical standards. In this sense, technology, as a «crystallization of socially organized action» (Sterne, 2003b), can be thought of «as a “strategic research site” for studying society and the organization of social practice. It is not

only technology but also the culture of technology that can reproduce social inequality» (Alper, 2017: 11).

This approach is no less relevant when discussing sound technologies, as seen in the recent development of sound studies (Sterne, 2012; Pinch and Bijsterveld, 2012). Mara Mills (2011; 2012; 2020) has recounted the shared history of sound devices such as the telephone and the audiometer, in which the instrumental measurement of “normal” human hearing was developed to allow for the more efficient transmission of speech over telephone lines. Through her research, she shows how the modern concepts of “impairment” and “hearing loss,” as well as the contributions of deaf and hard-of-hearing people, were central to the development of telecommunications technologies and signal processing in the twentieth century. Similarly, Jonathan Sterne’s first book, *The Audible Past* (2003a) locates the origins of sound reproduction in nineteenth-century sound culture, with its peculiar conceptions of hearing, speech, and deafness. In both cases, technologies and engineering had profound impacts on definitions of deafness and hearing impairment, as well as on definitions of what is a “normal” voice, while at the same time users with disabilities have often found themselves at the forefront of innovations in media systems that make them more useful for everyone. «Ideas of disability shaped the emergence of modern sound media and modern sound media shaped ideas of ability and disability» (Mills and Sterne, 2017: 369).

At the same time, the focus on sound technologies helps us to identify specific dynamics of legibility and validation related to impairment and disability. Mack Hagood (2017) suggests that mediation provides a form of validation of acoustic impairments such as tinnitus which are invisible and as such hardly legible in social terms. According to Hagood, our response to such conditions is exemplary of media’s tendency to be at the same time a vector of social and collective identity construction, but also a vector of indirect medicalization, functioning as a space where impaired people can look for normalization. This dynamic resembles that highlighted by Moser and Law (2003, p. 511): «First there is the desire of those who are able to ‘normalise’ those who are not. And then second, there is a loop: the desire by many of those who are disabled to be counted as competent or ‘normal’ by embracing normatively approved features of modern subjectivities». As noted by Kafer (2013), the rejection of the medical model in favour of the social one risks overlooking the lived experiences of impairment while politically marginalizing disabled people who are interested in medical interventions or cure. In terming her model “political/relational,” Kafer highlights the need to attend disability as the result of dynamics of power that shape particular relationships among people, institutions, culture, and material structures such as media, technologies and medical practices.

Taking inspiration from these perspectives, this paper argues that the *social model* promoted by disability studies could be improved by expanding into a *socio-technical model* which considers material and technical practices as crucial parts of the social construction of disability. Since such practices are very often enacted within both the medical context (through techno-scientific medical instruments) and the organizing context (through accessibility to certain structures or services, communication between people, groups and institutions, the definition of standards, etc.), this approach should carefully examine the processes of co-production of the disability construct in the interweaving of medical and scientific knowledge, technologically mediated agency and social and institutional statements.

By adopting this approach, disability studies would benefit from the contribution of organization studies and media studies in order to reveal the constructedness of disability and able-bodiedness and the role of media technologies, institutions, and representations in producing and upholding – as well as potentially challenging – such constructions and ideologies.

In the next sections this proposal will be articulated with regard to sound and voice technologies for disability, using as a case study Google's project of reuniting speech impaired people with their voices via voice cloning.

3. Representing disability through voice technology

In her taxonomy of representational strategies for depicting persons with disability, Rosemarie Garland Thomson (2001) individuates four visual rhetorics of disability: the wondrous, the sentimental, the exotic, the realistic. The documentary about Google's project of reuniting speech-impaired people with their voices through voice technology can be ascribed to the *sentimental rhetoric*, addressing what Oliver (1996) defines as "the tragedy model" of disability, which positions disability as a terrible issue for the afflicted individual. "Every single day is a struggle for me", Tim Shaw says through his synthetic cloned voice. Disability is represented here as an inherently "negative ontology" (Campbell, 2005). The emphasis emerging is that of an individualized medical interpretation of disability as biological or functional limitation; the narration leads to an attempt to *compensate* people with impairments, rather than *enabling* their full inclusion in social life. Technology, in particular AI, is seen here as a tool to achieve this compensation and reduce the tragic nature of the disability, a tool to "fix" the impaired person, overlooking the social conditions in which disability is constructed as such. Is not by chance that the title of the documentary episode is *Healed through AI*: through AI "a missing part" can be "put back in place". We can also see in this example a specific way of understanding the "cure", as a victory over a malfunction of the body which nonetheless doesn't affect the inner core of personhood. As a consequence, disability is considered as an "external" flaw or defect, and as such it can be (and should be) cured. "Yes my body is failing but my mind is not giving up" is what Shaw remarks in the documentary, using the cloned voice to speak.

Beyond the arguably noble intent of reuniting impaired people with their voices, careful deconstruction and analysis of Google's narration offers interesting revelations about how we treat and understand disability as a society. Through such analysis it's possible to unearth hidden connections between social constructions and cultural-epistemological attitudes which drive modern science and technology, of which AI is perhaps one of the most prominent outcomes. Google's narration seems in fact consistent with a certain sort of AI ideology: that human beings might be uploaded into new hardware whenever their old hardware wears out (Natale and Pasulka, 2019). This deceitful claim (Natale, 2021) is grounded on a metaphysical understanding of reality, insofar as it assumes the duality of mind and body and the superiority of the first over the second. This attitude denies both the social construction of disability and the embodied condition of subjectivity and identity, locating subjectivity rather in an abstract and supernatural "soul". Being disembodied, this kind of subjectivity is by definition "able", can't be affected or defined by any impairment, which remains by definition an external, bodily flaw. Furthermore, this disembodied subjectivity can be transferred from one body to another. Voice, with its traditional relation to metaphysical subjectivity (Derrida, 1967/2010), is the perfect representation of this condition: the possibility to transfer voice from a biological body to an electronic one as speech synthesis does (but also between different biological bodies through the computational medium, as it will be argued in the next section) is the metonymy of the supernatural status of inner subjectivity, of which voice is indeed the main expression. Voice, in fact, has been considered by western philosophy as the unmediated expression of an inner self, an attitude Derrida has named phonocentrism or metaphysic of presence. In this perspective, the loss of the voice would be the worst tragedy imaginable, a direct attack to the core of what makes us human. But voice is also

considered as a bodily thing, a mere interface with the purity of the inner self, which is in fact disembodied. As such, the loss of voice doesn't compromise the supposed ability of the inner self. It's in this perspective that a compensation for the loss of the voice can be in the first place imagined and then pursued by medical or technological means.

A similar attitude transpires from the recent case of Hollywood actor Val Kilmer, who, having lost his voice after a tracheotomy due to throat cancer, contracted with the company Sonantic to create a clone of his former voice, using a similar technological process as Google's. "I'm still the same person, the same soul... now, with artificial voice, I can express myself again", the actor declared (Flynn, 2021)³. The self to which he refers is the inner, untouched self of metaphysics.

This dualistic and metaphysical way of thinking requires the body to be considered only when it is separated from the "soul". The condition of uncorrupted ability granted on faith to that inner self is actually a myth, a "supplement" (Derrida, 1967/2010) which must necessarily be located outside the real body in an imaginary body, an abstract self or in a universal idea of ability. But if the self is disconnected from the body and not articulated with it, disability becomes less serious, because it can be considered as neither essential nor constitutive of the subject itself. This reproduces an ideology of ability as "fear of disability" (Siebers, 2008: 9), which is typical of a medical and rehabilitative model where personhood is considered as separate and abstract from disabled embodiment and experience – and as such not defined by it. Rather, taking embodiment seriously means overpassing a metaphysical (and ableist) perspective and facing disability as inherent to the human condition, a form of diversity which produces identity. As argued by Judith Butler (1990) and the many scholars interested in gender, race and disability who have built on her work, it is not possible to make sense of the construction of the person unless the body also forms part of the picture. Such an intellectual attitude has political consequences as well.

There are, therefore, two aspects which emerge from Google's representation of disability. On one side we can observe a technophile approach, informed by a kind of technological determinism that is classic of transhumanist ideologies: technology can, by itself, solve social problems, heal people, give access and opportunity. On the other hand, such an approach seems grounded in an «ideology of ability» (Siebers, 2008: 8) which assumes an original, untouched condition of ability and perfection, subsequently corrupted by disability, which must be restored through medical intervention and technology.

Such an approach assumes disability as an individual imperfection to be cured, rather than as a social construction to be confronted at the level of social justice. This model is rehabilitative and productive, aimed at fixing the individual to make her able again and ready to be (re)integrated into society, rather than questioning how it is the "ableist" social context itself that disables them. In both Google's narration and in Kilmer's words, the rhetoric of empowerment is viewed as an individualistic condition rather than a social one. It is the individual impaired person who is lacking and expected to conform to "being normal", while the social context is regarded as unproblematic (Swain, French and Cameron, 2003).

According to this interpretation, Google and other tech companies seem to affirm a medical model through their representations, producing *narratives of personal liberation via technology* which overlook the social construction of disability. These stories portray technology as allowing individuals to "overcome" their disability as an individual limitation, and at the same time are intended to be uplifting and inspirational for able-bodied audiences, assuming ability as an unquestioned and neutral condition in the first place. For this reason these narrations appear implicitly and essentially ableist. One consequence of this understanding of disability as an essentialized individual problem is that the (marginalized) subject position of disabled people is

³ https://www.youtube.com/watch?v=OSMue60Gg6s&ab_channel=Sonantic (accessed on 10/08/2021).

not problematized. As Ingunn Moser (2006: 373) puts it: «the mobilization of new technologies works to build an order of the normal and turn disabled people into competent normal subjects. However, this strategy based on compensation achieves its goals only at a very high price: by continuing to reproduce boundaries between abled and disabled, and normal and deviant, which constitute some people as disabled in the first place».

In her work about mobile technology and disability, Meryl Alper (2017: 23) notes that technological fixes intended to eliminate impairment presume a specific “image of the user”, one which views disabled people as people who need to be fixed. As underlined by several scholars (Siebers, 2008; Alper, 2017; Sterne, 2021), this condition reflects a paradox inherent to *assistive technology*. All technology, in fact, is assistive at a certain degree. Nevertheless, technology is defined “assistive” only when is designed and marketed with impaired people in mind. In this way “assistive technology” assumes a specific and ideological representation of its intended users, users who are implicitly defined as “people who need assistance”. This is a powerful example of how an ideology of ability *disables* impaired people through its discourses and representations, and of how the construct of disability works to marginalize certain people and groups. Could the growing popularity of “voice assistants” such as Siri or Alexa be undermining this narration by blurring the boundaries between kinds of people who need assistance? In general, unmasking disability as a construct – i.e. through the deconstruction of mainstream representations – serves to denaturalize dynamics of exclusion, undermining the assumption of ability as a normal condition while problematizing the very concept of ability, especially in a technological landscape in which we are all assisted and “augmented” by technology.

Of course, disability isn’t constructed only through representations. The metaphor of “giving voice”, in fact, opens to other perspectives if analyzed from the point of view of material practices.

4. “Giving Voice” between metaphor and materiality

In western cultures, the term “voice” is used both in symbolizing human speech and as a powerful metaphor for agency, authenticity, truth, and self-representation (Hirschman, 1970). As noted by Alper (2017), in communication technologies these two meanings often converge. Since the ‘70s and the ‘80s, technological devices which allowed speech-impaired people to communicate have been represented as “giving voice” to those who can’t physically speak, quietly implying that technology is also metaphorically empowering those who have been silenced by normative and ableist environments. With voice technologies such as speech synthesis and voice cloning, the literal sense of “giving voice” seems to surpass even the metaphorical one. Voice cloning in particular is presented as a technology which can give speech-impaired people their own voice back. In fact, as already outlined, it doesn’t produce merely a generic synthetic voice which can allow people who have lost their voice to express words audibly; rather it reconstructs the voice of a specific person, with the sonic, timbral and prosodic characteristics which make it unique and personal. Voice cloning, we could say, is like a mask used to customize and personalize already existing communication technologies based on speech synthesis, such as text-to-speech, voice interfaces and other assistive tools, in order to give them a touch of realism and naturalness (Napolitano, 2020a). In this way, such technology overcomes typical limits related to the cold and robotic character of synthetic voices, acquiring a “human touch” which makes it more acceptable and usable, better able to deal with four aspects of identity performance (as proposed by Alper, p. 51): sounding one’s age, sounding human, sounding related to one’s family members, and sounding consonant with one’s cultural background.

But is this enough to “give voice” to someone? Can a voice that sounds like mine be considered really mine? And, more in general, what does it mean to “own” a voice?

Commodification is the name of the condition necessary for something to be “owned”, “given” and “given back.” Therefore, a commodification of the voice is necessary in order to give it (back) to someone or to reunite someone with it. Recent studies (Connor, 2000; Sterne, 2003a; Ernst, 2016; Napolitano, 2020a) have investigated the social, cultural, historical and epistemological conditions of the commodification of the voice in different technological periods, analyzing the different media through which voice has been stored, manipulated and re-enacted, from alphabetic writing to speaking automata, from the phonograph to the computer. At the base of these studies there is the consideration that voice is never the pure immediate expression of an inner self, as stated by the metaphysic of presence, but is always mediated. Although the idea of commodification seems to point towards ontology, commodification of the voice is in fact a recognition that voice is not a static entity but rather something defined socio-technically by the intersection of media, cultural ideas and forms of embodiment. «‘Voices’ do not exist in and of themselves. They do not reflect something that is pre-given. Rather they are constituted or ‘articulated’ into being in material arrangements which include social, technological and corporeal relations» (Moser and Law, 2003, p. 491; see also Napolitano, 2020b).

Therefore, to understand the specific socio-technical definition of voice enacted by voice cloning techniques, it’s important to consider the assemblage of material practices and operations of the medium, together with discourses and metaphors. Adopting a constructionist perspective, a definition voice-impairment derives directly from this assemblage, since it is only within it that the idea of a “normal” and of a “personal” voice acquires its sense. Therefore, it’s only within the socio-technical assemblage that we can get to the sense of “giving voice”... and deconstruct it.

For the purpose of our discussion, it is important to highlight the following material aspects:

Voice cloning employs machine learning algorithms (the most current declination of AI) to determine the features of a person’s voice profile – those characteristics which differentiate it from that of another person – starting from the *data* of that voice (Marr, 2018). This has two consequences:

1. The collection of such voice data becomes crucial to the successful operation of the technology. This leads to the articulation of socio-material practices of voice data collection, such as *voice banking*, which must be pre-emptive. That is, they must happen before someone experiences significant speech impairment (or as soon as one is diagnosed with a degenerative disease). This has implications which reach beyond the simple act of speaking, associating voice banking with cultural practices related to saving, preventing, leaving traces, making a will (not so far from having to decide in advance whether to be an organ donor).
2. Voice cloning relies on a sort of essentialist epistemology based on the assumption that voice is something that can be *owned*. It assumes that each person owns a voice, her own voice, and this voice can be translated into data with little or no loss from the “original”, embodied one. This means affirming a quantitative correspondence between voice and sound data and between sound data and identity, all of which has practical and political consequences such as the possibility to profile people from the measurement of their voice features, ever more included in forensic practices of automatic speaker identification (Singh, 2021).

Voice technologies in general, and voice cloning in particular, enact specific forms of embodiment:

1. A synthetic voice doesn't come from the person's mouth nor from the body, but rather from a loudspeaker. The assumption that a voice which doesn't come from someone's mouth can still be considered as someone's own voice is something that destabilizes naturalizing ideologies of "presence" (Derrida, 1967/2010) and universalist conceptions of the body, of the voice and of the identity (Sterne, 2021). Those conceptions, in fact, are grounded on a latent normative assumption about what a voice is and where it comes from; assumptions which can be reproduced and even enhanced by sound media. Speech synthesis algorithms, for example, need to measure bodily features of voice and mouth and to extract standards from those measures in order to artificially recreate someone's voice (Napolitano, 2020b). In so doing, sound technologies «render abstract human qualities as measurable quantities» (Mills and Sterne, 2017: 369), defining operatively and scientifically what a voice is, and how it should sound.

2. At the same time, and in an equally relevant way, voice cloning technology seems to take a step beyond the normative perspective: as vocal features are made to emerge directly from the data, which is a prerogative of machine learning algorithms, this technology is not attempting to synthesize a "pre-defined" standard voice, but rather to get to the singularity of each voice, in its peculiarities and without reference to standards, capturing also the "imperfections" and deviations from the norm that make each voice unique. Although recalling imperfection is still a way to re-enact an ableist model, things like unsupervised learning and deep learning seem to rely less and less on standards, models and norms, moving more and more towards immanently emergent behaviors. While this opens to a very wide debate about a possible "end of theory" (Anderson, 2008; Napolitano, 2020b) which goes beyond the scope of this paper, it is nonetheless relevant that the material operations by which such technologies function offer a glimpse of an epistemological shift. This makes AI look like a promising technology when discussing disability, because instead of looking for norms among the variations, it opens the technology to the differences which characterize disability as itself «a form of human variation» (Siebers, 2008: 25) – a material practice that collides with the mainstream deceptive narration about AI described in the previous section. One consequence of this can be observed in the fact that voice cloning, bypassing classic issues with synthetic voice, sidesteps the problem of avoiding gender, race and class stereotypes culturally coded into pre-defined voice characters. The fact that features of a person's body can be built into a synthetic voice (indeed, it is these very factors which make that voice personal) represents more than mere engineering of the human body with rehabilitative aims (Hamraie, 2017: 15): it can also be seen as another form of technological embodiment.

3. Despite this, voice cloning doesn't seem to question the idea of "normal speaking ability" which it reproduces through text-to-speech systems. Even if the *sound* of the voice is individual, the *way of speaking* performed by those systems is still quite standardized based on certain social expectations, which are in turn based on ideas of ability. This might be a purely technological gap, which will be soon compensated by new features that allow users to control the way of speaking (Sonantic is already working on such software). But it should also be seen as another clue of how sound media shape ideas of ability and disability through their very operations, while disability in turn shapes ideas about sound media (Sterne & Mills, 2017). This co-production of media and disability is evident when considering that, while being

employed to treat speech impairment, voice cloning is also spreading as a cultural practice in the media environment, from worrying *deepfake* phenomena in which the voice of someone is cloned to be used in frauds – i.e. to make digital voices say things their human inspirations never pronounced (Wilson, 2018) – to *voice skins* in which people, especially videogamers, can swap their voice in real time with that of others (MODULATE, 2020). In all these examples we can see new forms of technological embodiments which short-circuit with the traditional assumptions of able-bodiedness, above all the logocentric one that assumes the natural and unmediated correlation of body and voice.

Therefore, while still characterized by a certain medical rhetoric, the spreading of voice cloning and the specific material operations and practices it enacts are shaping disability as a social construct, insofar as they question assumptions of embodiment and ability even beyond the context of speech-impairment.

In light of these considerations, “giving voice” assumes a peculiar meaning. More than a metaphor, “giving voice” becomes a social and cultural practice based on the material possibility of loosening the ableist model which considers voice, body and subjectivity as given and intrinsically bond together. Voice technologies such as speech synthesis play a crucial part in this shift, since they offer examples of the way in which voice is articulated into being in material arrangements which include social, technological and corporeal relations.

To complete the picture, we should not underestimate the socio-economic conditions which necessary to allow “giving voice” as well as “giving back the voice”. Someone can “give back” something only from a position of power, and in the case of AI-based voice technology, the power to give back the voice comes from a position of absolute techno-economic domination of tech giants like Google. To give back the voice means to think of the voice as something that can be possessed, but also as something that can be subtracted: rendering voice into data entails both being able to re-construct it and to catch it, recognize it, capture it into neoliberal dynamics of profiling and surveillance (Turow, 2021). Being in the position to “give back the voice”, these companies in a certain sense “dispose” of the voice of those who have lost it, they appropriate it (mainly in the form of data). Which metaphorically but also materially corresponds to the reproduction of a power relationship in which those who can “give back” can also “take away” and “reduce to silence”. As Moser and Law (2003: 499) underline, «‘giving a voice’ also takes away other possible voices».

Based on all of these elements, technologies for disability seem characterized by a certain tension: while enhancing agency and access for impaired people, such technologies often reproduce a paradigm of rehabilitation that subdues individuals to a direct or indirect system of power based on normalization and productivity. In this regard, Alper’s (2017: 2) words seem a good closure:

‘Giving voice to the voiceless’ regularly stands in for the idea that the historically disadvantaged, underrepresented, or vulnerable gain opportunities to organize, increase their visibility, and express themselves by leveraging the affordances of information, media, and communication technologies [...] These tools may selectively amplify voices within and across various publics and audiences, but their existence does not automatically call the status quo of structural inequality (i.e., racism, patriarchy, misogyny, and homophobia) into question.

5. Conclusion

In this paper I've described how sound media, and voice technologies in particular, shape ideas of disability while in turn being shaped by disability. This co-constitution takes place through discourses, representations and material practices of organizing, programming, using, and embodying voice through technology. Instead of considering these technologies just for their assistive potential, I have considered them as places where knowledge about disability is produced, represented and enacted. In this sense, the parallel analysis of different aspects allows cultural and social ideas about disability embedded within them to emerge, highlighting how the persistence of a medical model of disability, especially in the representations of technology, is intertwined with social considerations emerging from material practices. On the one hand, narratives of personal liberation through technology, such as those proposed by Google or Sonantic, reveal the persistence of an ableist model grounded in a metaphysical idea of the bond between voice and subjectivity, resulting in a marginalization of disability as an external flaw to be cured. On the other hand, practices of data collection and technological embodiment enacted by voice cloning reveal an epistemological sensitivity to human variation which can lead to more inclusive understandings of disability.

In my perspective, these instances should not be considered as in opposition. Rather, I see them as co-constitutive of the social construction of disability. While this perspective is consistent with what has been defined as the social model of disability, I've proposed to call it a socio-technical model, in order to underline its emphasis on the complex assemblage of knowledge, cultural values, collective images of the user, material operations and organizational practices built into technologies and through which disability is shaped and defined.

From such a perspective, the study of voice and sound technology can be meaningful both as a site of knowledge production about disability and as an example of the productive collaboration between media studies and organization studies in the framework of disability studies. This is particularly evident since organizations are the sites where such knowledge is translated into individual and collective agency through policies and laws as well as through accessibility and communication practices and strategies.

Moreover, considering the centrality assumed by material processes in this perspective, such a collaboration could direct the theoretical and social analysis of the technologies of disability toward a better and more inclusive design of both artifacts and their organizational contexts, one that accommodates a wide range of bodies without reproducing dis/abled divides – one which keeps disabled people in mind.

Keywords: sound technology, speech synthesis, voice cloning, disability studies, media studies, organization studies.

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