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Crip Technoscience Manifesto

Aimi Hamraie
Vanderbilt University
aimi.hamraie@vanderbilt.edu

Kelly Fritsch
Carleton University
kellyfritsch@cunet.carleton.ca

Abstract

As disabled people engaged in disability community, activism, and scholarship, our collective experiences and histories have taught us that we are effective agents of world-building and -dismantling toward more socially just relations. The grounds for social justice and world-remaking, however, are frictioned; technologies, architectures, and infrastructures are often designed and implemented without committing to disability as a difference that matters. This manifesto calls attention to the powerful, messy, non-innocent, contradictory, and nevertheless crucial work of what we name as "crip technoscience," practices of critique, alteration, and reinvention of our material-discursive world. Disabled people are experts and designers of everyday life. But we also harness technoscience for political action, refusing to comply with demands to cure, fix, or eliminate disability. Attentive to the intersectional workings of power and privilege, we agitate against independence and productivity as requirements for existence. Instead, we center technoscientific activism and critical design practices that foster disability justice.

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Introduction

As disabled people engaged in disability community, activism, and scholarship, our collective experiences and histories have taught us that we are effective agents of world-building and -dismantling toward more socially just relations. The grounds for social justice and world-remaking, however, are frictioned; technologies, architectures, and infrastructures are often designed and implemented without committing to disability as a difference that matters. This manifesto calls attention to the powerful, messy, non-innocent, contradictory, and nevertheless crucial work of crip technoscience: practices of critique, alteration, and reinvention of our material-discursive world.

Disabled people are experts and designers of everyday life. But we also harness technoscience for political action, refusing to comply with demands to cure, fix, or eliminate disability. Attentive to the intersectional workings of power and privilege, we agitate against independence and productivity as requirements for existence. Building upon earlier work defining crip technoscience as politicized design activism (Hamraie, 2015, 2017), we articulate four political commitments of crip technoscience as a field of critical scholarship, practice, and activism.[2] In framing crip technoscience as such, we follow feminist technoscience studies by describing both a realm of practice *and* a field of knowing that has emerged from it. Crip technoscience braids together two provocative concepts: "crip," the non-compliant, anti-assimilationist position that disability is a desirable part of the world, and "technoscience," the co-production of science, technology, and political life (Jasanoff, 2004; Murphy, 2012). Crip theory centers disability as a locus of resistance against "compulsory ablebodiedness" (McRuer, 2006) and "ablenationalism" (Mitchell & Snyder, 2015), agitating against liberal assimilation and inclusion practices by marking disability as a desirably generative and creative relational practice (Fritsch, 2015a).

We seek to bring crip theory and feminist technoscience into closer contact, exploring their generative frictions. In some respects, the field of

disability studies has been entangled with science and technology studies (STS)—and feminist STS in particular—since its origins, especially through its critiques of biomedicine and militarism and in its embrace of situated epistemologies. In naming crip technoscience, we invoke long histories of feminist, queer, anti-racist, and disability collaborative praxis, such as in technoscience projects engaging Universal Design, sensory engineering, reproductive justice, and HIV/AIDS activism.[2] However, to date, *crip* theorists have had limited engagement with the *critical* concept of technoscience, particularly as it is used in feminist STS to mean the productive and non-innocent entanglement of scientific knowing and technological making.[3] This limited engagement has yielded an ahistorical position that science, technology, and medicine are anathema to crip world-remaking, ignoring disabled peoples' ongoing, creative, and open-ended appropriations of science, technology, and medicine, particularly in acts of protest and "epistemic activism" (Hamraie, 2012, 2017, p. 132). Crip technoscience thus calls forth Leah Lakshmi Piepzna-Samarasinha's concept of "crip science" (2018, p. 69) to highlight the skills, wisdom, resources, and hacks disabled people utilize for navigating and altering inaccessible worlds.

In pushing crip technoscience as a field of research and a practice of critical "knowing-making" (Hamraie, 2017, p. 99), we conjure frictional practices of access production, acknowledging that science and technology can be used to both produce and dismantle injustice. As a field of study, crip technoscience begins from the feminist politics of technoscientific "non-innocence" (Haraway, 1991), acknowledging that many of the technologies that have enabled disabled people to gain access to the social world have been produced through military-industrial research and development, imperial and colonial relations, and ecological destruction, all of which contribute to the uneven debilitation of human and non-human life (Erevelles, 2011; Fritsch, 2015b; Kafer, 2013; Puar, 2017). Nevertheless, we contend that technoscience can be a transformative tool for disability justice.

We contrast crip technoscience with mainstream "disability

technoscience" as a field of traditional expert relations and practices concerned with designing *for* disabled people rather than *with* or *by* disabled people. In mainstream disability technoscience, such fixes are understood as de facto goods, services for (supposedly) unfortunate disabled people, and ultimately depoliticized. Disability technoscience positions enhancement and capacitation as progressive moves to overcome disability. "Hackathons" led by charity organizations embody innovation-for-innovation's sake and define disability as a problem in search of a solution (Wong, 2015a, 2015b). Disabled people are often treated purely as clients or users. For example, the organization Tikkun Olam Makers (TOM) describes disabled people as "need knowers" and non-disabled designers and engineers as "solution experts." Riffing on the term *special needs*, which associates disabled people with minority interests outside of majority norms, these designations reinforce the division between disabled people as passive recipients of access or assistive technologies and non-disabled designers, developers, and technologists as experts.

Disability technoscience reinforces the sense that disabled people are not already making, hacking, and tinkering with existing material arrangements. Disability is cast as an object of innovation discourse, rather than as a driver of technological change. Melanie Yergeau (2014) historicizes mainstream disability "hacktivism," arguing that hackathons have become the "new telethon" in that they frame "disability as pitiable and in need of remediation."[4] In response, Yergeau invokes "criptastic hacking" as a "disability-led movement, rather than a series of apps and patches and fixes designed by non-disabled people who cannot even be bothered to talk with disabled people." Criptastic hacking highlights crip technoscience as a field of relations, knowledges, and practices that enables the flourishing of crip ways of producing and engaging the material world.

In contrast to dominant forms of knowing-making *for* disability, we invoke crip technoscience to describe politicized practices of non-compliant knowing-making: world-building and world-dismantling practices *by* and *with* disabled people and communities that respond to intersectional systems of power, privilege, and oppression by working within and around

them. Within feminist STS, we find a valuable openness to the possibilities of material production, including feminist hacking and coding (Haraway, 1991), "tactical biopolitics" (Da Costa & Phillip, 2008), and "critical making" (Ratto & Boler, 2014; Sayers, 2018), practices that push technoscience beyond the military-industrial into the realms of activist resistance and world-remaking. This openness manifests in Donna Haraway's "Cyborg Manifesto" (1991), which inaugurated a tradition of feminist technoscience and activism. While acknowledging the non-innocent entanglement of most technologies with militarism and capitalism, Haraway calls for "modest witnessing," simultaneously resisting systems of domination and finding ways to hack and tinker with them (1997, p. 3). She frames modest witnessing in terms of "socialist and feminist principles of design" (p. 161), maker practices that could work "in alliance with anti-military science" (p. 169). Feminist scholars such as Michelle Murphy (2012) have built upon the work of activist technoscience to describe what Murphy calls "protocols" of feminist knowing and making. The promise of feminist technoscience lies in challenging hegemonic narratives about technology as always enframing or deterministic, and in imagining the transformative possibilities for crip hacking, coding, and making as frictional access practices.

While critical making is recognized as part of the feminist STS tradition, disabled peoples' maker practices have not yet been fully considered in the radical political history of disability studies. The capaciousness of feminist technoscience studies emboldens our conviction that critical technoscience, so much a part of our crip political history and genealogy, can also provide the discursive tools for embracing disabled people as experts, makers, and activists resisting mainstream disability technoscience. We call for crip technoscience scholarship and practice as modest witness, holding in tension the non-innocence of military-industrial science, technology, design, and media with the imperatives for disability justice, accessibility, and world-remaking.

Disabled people design our own tools and environments, whether by using experiential knowledge to adapt tools for daily use or by engaging in professional design practices. Crip technoscience conjures long histories of

daily adaption and tinkering with built environments. We remember the crucial world-building work of Independent Living activists who learned to code, repair wheelchairs, and plan cities while refusing to remain institutionalized. We also invoke disability activism that centers the remaking of the material world as a central protest tactic, whether by smashing curb cuts with sledgehammers or pouring curb ramps with bags of cement (as ADAPT activists have done), by staging direct actions with mobility devices (as in the case of protesters leaving behind wheelchairs and crutches to crawl up the steps of the US Capitol Building, or in the case of Nelia Sargent, a blind woman who chained her power wheelchair to a nuclear reactor building in 1976 [Giordano, 2013]), or by occupying media spaces (such as the Jerry Lewis telethon) to contest the rendering of disabled bodies as defective and in need of a cure (Longmore, 2015). We invoke the history of disabled resistance to assistive technologies (such as Audre Lorde's [1997] refusal to wear a breast prosthesis), as well as to war and militarism (as in the case of veteran Ron Kovic, who staged a demonstration at the Republican National Convention, "show[ing] their solidarity by gripping the arms of each other's wheelchairs while they are being pushed by others" [Wolfson, 2014, p. 120]).[5] We respect the leadership of contemporary disability justice movement leaders, such as Alice Wong (2019) and Vilissa Thompson (2019), whose strategic use of media technology to challenge dominant narratives about disability (through the Disability Visibility Project and Ramp Your Voice! websites, Twitter feeds, and related podcasts) also demonstrates collective power. While crip technoscience seeks to disrupt ableist and capitalist military-industrial systems, we also center contemporary liberatory projects for "collective access" (Mingus, 2010b; Piepzna-Samarasinha, 2018). To struggle for a more accessible future in which disability is anticipated, welcomed, and in which disabled people thrive, we offer four commitments of crip technoscience as a field of critical scholarship, practice, and activism.

Four Commitments of Crip Technoscience

Crip technoscience centers the work of disabled people as knowers and makers. Crip technoscience privileges disabled people as designers and world-builders, as knowing what will work best and developing the skills, capacities, and relationships to make something from our knowledge. Unlike typical approaches to disability that objectify disabled people and situate expertise in medical professionals and non-disabled designers or engineers, crip technoscience posits that disabled people are active participants in the design of everyday life. Not only do disabled people make access in our everyday lives in ways that do not get recognized as design, but the lived experience of disability, and the shared experience of disability community creates specific expertise and knowledge that informs technoscientific practices.

We call for greater acknowledgement of the lived experiences and material design practices of disabled people in the work of technoscientific intervention. There is a widespread perception that access technologies are made for us by non-disabled experts, but there is little recognition of our own practices of remaking the material world. Yet the field of disability scholarship grew out of activism against rehabilitative models of medical expertise and intervention (UPIAS, 1976), crafting a materialist politics with anti-capitalism at its center (Oliver, 1990; Russell, 1998), and continues to struggle against "compulsory ablebodiedness" (McRuer, 2006). Crip knowing-making forms the basis of political slogans such as Nothing About Us Without Us (Charlton, 2000), framing disabled people not just as design experts but also as epistemic activists whose politicized ways of knowing the material world also situate us to produce the material conditions that allow disability to thrive, in addition to remaking how disability is known and experienced. Without glorifying do-it-yourself design practices, crip technoscience recognizes that disabled peoples' world-dismantling and world-building labors stem from situated experiences of "misfitting" in the world (Garland-Thomson, 2011). Crips are not merely formed or acted on by the world—we are engaged agents of remaking.

In centering the expertise of disabled knowers and makers, crip

technoscience involves the use of materials and technologies to produce forms of access otherwise unavailable (or economically inaccessible) via mainstream assistive technology channels. There are many examples of disability experience as knowing-making, so many creative and ingenious ways of living in the world. For example, historian Bess Williamson (2012a) has traced the ways that disabled people in the American postwar period documented their work as "tinkerers" in community periodicals, retrospective memoirs, and oral histories. They adapted specialized medical and assistive equipment, altered their houses, and repurposed everyday household tools. Disabled people turned away from medical supply companies to hardware stores to alter objects to their own advantage, asserting their "presence in a world that largely ignored them" (Williamson, 2012a, p. 12). Disabled designers such as Alice Loomer (1982), a wheelchair user, described her crip maker practices of repurposing household items for wheelchair maintenance or for ad hoc assistive technologies as "hanging onto the coattails of science." Loomer argued that her own tinkering and maintenance practices "kept [her] away from nursing homes and attendants": "I made it. So I know how to fix it…I may have failed as often as I succeeded, but I have equipment that fits me" (p. 30-31). Loomer's work complicates the typical association of the disabled cyborg with a desire for innovation, instead turning to maintenance practices as sites for examining the "frictions, limitations, and failures inherent to technoscientific design processes" (Hamraie, 2017, p. 107).

Similarly, in the 1960s, disabled engineer Ralf Hotchkiss hacked his wheelchair to plow snow off sidewalks while attending Oberlin College, and in the 1980s began the Whirlwind Wheelchair International, when his global travels to find better designs for wheelchairs took him to Nicaragua:

> I met these four young fellows sharing one wheelchair, and they had already redesigned that wheelchair. They had ridden it so hard that it had broken in 20 different places. They had reinforced it, welded it all back together, and made it much stronger than it had been. And they knew so much about good wheelchair design. It was clear they were the people I was looking for to help me, and I could help them

> as well, so we've been working together ever since. (Hotchkiss, 2011)

While wheelchair users are not often treated as engineers, the four disabled designers had become experts in wheelchair engineering through trial and error and ingenuity, an ethos that continues in Whirlwind Wheelchair International's low-cost, open-source wheelchairs, which are intended to be maintainable for a lifetime, enabling a broader range of people to access them.

More recently, designer Sara Hendren and anthropologist Caitrin Lynch's (2016) project Engineering at Home has called attention to the ad hoc design practices of "Cindy," a recently disabled woman with several amputations. While Cindy "received the best available 'rehabilitation engineering' technology that money can buy," she nevertheless "found she had little use for it," opting instead to use tools of her own design (Hendren & Lynch, 2016). Hendren and Lynch frame Cindy's work as "user-*initiated* design," which can "yield a powerful course correction to the top-down modes of manufacturing." Another disabled designer, Sarah Welner, began her career as an obstetric surgeon before focusing on gynecological health for disabled people. Recognizing that "conventional examining tables are too high and narrow" for disabled women, particularly wheelchair users, Welner designed a table with a button-operated "hydraulic lift" and more comfortable foot rests (Waldman, 1998). While the engineering and design professions have historically excluded women, Welner, Loomer, and Cindy's work are clear examples of the places where crip technoscience and feminist design practices meet. Gender and disability expertise diffract through one another to question dominant modes of knowing and making.

Disabled parents have also been agents of crip knowing-making. Disabled parents hack baby cribs and change tables, sew bells on children's clothing to enable blind parents to keep track of their children when moving through public spaces, and mount car seats on portable luggage carriers to enable blind parents who use white canes or have a guide dog to pull their child behind them with their free hand (Fritsch, 2017). Wheelchair users adapt slings, wraps, and nursing pillows to carry babies and toddlers on

their laps. Other parents invent various tools to help feed and bathe their children, get them dressed, do their laundry, put on shoes, zip up coats, and engage in play. Queer, gender non-conforming, and trans disabled people also hack and tinker with reproductive technologies and kin formation to become pregnant, gestate, chest feed, and share responsibilities. All these forms of knowing-making are shared on social media (such as with the Disabled Parenting Project's website, blog, Twitter feeds, and related video projects), through disability community publications and events, and during conversations at parks and playgrounds. While disabled people face a multitude of barriers to becoming parents, disabled parents hack, tinker, and alter our material-discursive world, creating crip communities of knowing and making that challenges normative assumptions about parenting as a non-expert consumer activity.

Crip technoscience is committed to access as friction. Emerging out of historical fights for disability rights, the terms *accessibility* and *access* are usually taken to mean disabled inclusion and assimilation into normative able-bodied relations and built environments. When viewed as synonymous with inclusion and assimilation, access and accessibility are treated as self-evident goods.[6] As Kelly Fritsch explains, however, the etymology of the word *access* reveals two frictional meanings: access as "an opportunity enabling contact," as well as "a kind of attack" (2016, p. 23). Taking access as a kind of attack reveals access-making as a site of political friction and contestation. While historically central to the fights for disability access, crip technoscience is nevertheless committed to pushing beyond liberal and assimilation-based approaches to accessibility, which emphasize inclusion in mainstream society, to pursue access as friction, particularly paying attention to access-making as disabled peoples' acts of non-compliance and protest. For example, before enforceable disability rights laws in the United States, disabled people took direct action to create ramps and curb cuts, making obvious the inaccessibility of the built environment. Disability activists have taken sledgehammers to sidewalks in acts of protest, using bags of cement to pour curb cuts, and have used the design of curb cuts and ramps (conceived as levers for facilitating participation) as sites of

productive friction through which interdependence-based disability politics could arise (Hamraie, 2017, p. 99-102).

The Independent Living movement has also used material experimentation to enact crip technoscience and access friction. While the movement was critical of rehabilitation as a field of expert knowledge, it did not refuse the language or tools of rehabilitation outright. In addition to appropriating the term *Independent Living* to promote a disability politics of interdependence, the movement understood technoscience as a site of politicized resistance and regularly used hacking and tinkering practices as the basis of disability organizing. Many of their methods are captured in designers Ray Lifchez and Barbara Winslow's book *Design for Independent Living*, produced in collaboration with the movement. The book reveals the everyday technological hacks that disabled people in Berkeley in the 1960s and 1970s developed to thrive in an inaccessible city. Emblematic of the movement's crip technoscience ethos, Lifchez and Winslow offer the concept of "non-compliant users," illustrating this with an image of a powerchair user wheeling against traffic on a street without curb cuts (1979, p. 153). This technology-enabled movement against the flow of traffic marks anti-assimilationist crip mobility: not an attempt to integrate (as in the liberal approach to disability rights), but rather to use technology as a friction against an inaccessible environment.

More recently, Toronto resident Luke Anderson was frustrated by the lack of wheelchair access he experienced on a daily basis. Trained as a structural engineer, Anderson designed a simple portable wooden ramp in 2011 stenciled with the URL "stopgap.ca" and gifted thirteen of these ramps to businesses in his neighborhood. Built as a temporary "stop gap" measure to improve accessibility, the ramps are a non-compliant technology; they are not intended to be a permanent solution or structure, do not have to follow building codes, and do not require a city building permit or variance, all of which can be expensive and difficult to obtain. Anderson's experiment took off, leading to the formation of the StopGap Foundation and the Community Ramp project, which has now distributed over 1,200 portable wooden ramps worldwide (Fritsch, in press).

In another contemporary example of access as friction, Collin Kennedy, a cancer patient in Winnipeg, Manitoba, protested hospital parking prices by filling the pay-slot on a parking meter with spray foam, telling the local news that he planned to continue doing so "until changes are made" (Canadian Broadcasting Corporation [CBC], 2016). When crip time came into friction with the hospital's parking meter time, Kennedy challenged health capitalism: "You should be able to come here, park, get your treatment, however long that treatment takes…This is a medical facility where people are not going for entertainment. They're not going for productivity and commerce. We're here because of life and death" (CBC, 2016). Kennedy's activism—the use of spray foam to obstruct the parking meter—creates frictional access through attacking a technology of capitalist time and contests the commercialization of health care.

Crip technoscience is committed to interdependence as political technology. We position the crip politics of interdependence as a technoscientific phenomenon, the weaving of relational circuits between bodies, environments, and tools to create non-innocent, frictional access. Mainstream disability technoscience presumes disability as an individual experience of impairment rather than a collective political experience of world-building and dismantling. This perception has two primary consequences. First, disabled people are perceived as dependent and the goal of technoscience becomes to encourage *independence*. Second, disability and technology are both perceived as *apolitical* and stable phenomena, rather than material-discursive entanglements that take shape through struggle, negotiation, and creativity.

The crip analytic of interdependence helps us understand how technoscience can simultaneously be entangled with global networks of domination and also provide opportunities for kinship and connection. Donna Haraway's (1991) cyborg figure, for instance, has been taken as a material metaphor for the entanglement of nature and techno-cultures. This figure has shaped the critical concept of technoscience by showing the networks of knowledge and material production that comprise global capitalism as a force organizing relations between bodies, technologies,

and environments. Disability critics of the cyborg figure, however, argue that Haraway's approach to the cyborg takes for granted that disabled people easily meld into technological circuits, an assumption shaped by imperatives for rehabilitation, cure, independence, and productivity. As Alison Kafer (2013) demonstrates, the imagination of disability in feminist technoscience is often limited to either eugenicist ideals of a disability-free future or to "depoliticized" ideals of the cyborg hybrid body (p. 8-10); disability is either a "master trope of human disqualification" (Snyder & Mitchell, 2006, p. 125) or a "seamless" integration of body and machine (Kafer, 2013, p. 105). Frequently, feminist technoscience conflates "'cyborg' and 'physically disabled person'" (p. 105), treating disabled people as "post-human paragons" (Allan, 2013, p. 11). Even when taken up critically, the cyborg figure in feminist technoscience reinforces ideas about disability as lack and disqualification (Bailey, 2012).

If, as Kafer argues, disabled people have often uneasy or "ambivalent relationship[s] to technology" (2013, p. 119), our practices of interdependence, access intimacy, and collective access can be understood as alternative political technologies: "disabled people," she writes, "[are not] cyborgs…because of our bodies (e.g., our use of prosthetics, ventilators, or attendants), but because of our political practices" (p. 120). Crip technoscience offers interdependence as a central analytic for disability–technology relations, recognizing that in disability culture, community, and knower-maker practices, interdependence acts as a political technology for materializing better worlds. In alliance with Moya Bailey and Whitney Peoples's call for "black feminist health science studies," crip technoscience is "suspicious of the individualism and siloing practices rewarded in the academy and see[s] collaboration and interdisciplinary as core" values that ought to guide intellectual and material production (Bailey & Peoples, 2017, p. 18). These values extend beyond the academy, however. As disability justice activist Mia Mingus (2010a) writes, interdependence offers a politics of crip alliance and solidarity: "It is truly moving together in an oppressive world towards liberation….It is working in coalition and collaboration." We call for crip technoscience to

design for collective access and disability justice.

We find interdependence as a political technology throughout the history of disability activism. For example, in North American disability activist histories, the most frequently narrated of these is the story of the "504 protest," which took place in 1977 when disability activists in Berkeley, California, occupied the Department of Health, Education, and Welfare to protest for the enforcement of section 504 of the Federal Rehabilitation Act, a law that mandated accessible federal programs, spaces, and services. Activists in the Independent Living movement had sought to foster a "cross-disability consciousness" across mobility-disabled, blind, and Deaf people (Zukas, 2000, p. 141). At the protest, they transformed this consciousness into a political technology, using ASL to communicate with the outside when phone lines were cut off, rigging an air conditioner from other mechanical parts in the building, and establishing networks of care (O'Toole, 2000, p. 47). Similar narratives have been told about the birth of Autistic community through organizing made possible by the internet and Autistic-accessible conference spaces (Sinclair, 2010) and are currently being written through new crip technoscience projects (such as those highlighted in the Critical Commentary section of this issue). These and other material practices describe a crip technoscientific sensibility wherein disabled interdependence also enables what Mingus (2017) calls "access intimacy," a crip relational practice produced when interdependence informs the making of access.

Crip technoscience also plays with the boundaries of trust, interdependence, and crip relations. Blind artist Carmen Papalia, for instance, stages crip uses of technology in public space. In one practice, Papalia uses a twenty-foot white cane on busy streets to create a sense of antagonism with other pedestrians, which renders access as a frictioned practice; in another, called "Blind Field Shuttle," Papalia leads groups of (sighted) people on walks with their eyes closed. Both practices make use of a technology—Papalia's white cane—to stage social interactions in public space that put ideas of independence into question (Papalia, 2013).

Also drawing on crip political interdependence, Georgina Kleege and

Scott Wallin's (2015) practice of "participatory description" compels narrated visual content through group-based methods. Unlike the traditional role of audio description "as a detached, neutral act of translation that functions only as an enabling accommodation," participatory description uses technoscientific modes, including internet video databases, to "explore the aesthetic, ideological, political and ethical underpinnings of this work of representation and its described object or event."

Participatory audio description has also influenced the emergence of new technoscientific tools for accessibility mapping projects. Blind designer Josh Miele, for instance, worked with Touch Graphics, Inc. to design tactile and audio maps of the Bay Area Rapid Transit system. Other projects use mapping for collective access. Unlike mainstream disability technoscience "crowdsourcing" projects, which invoke a charity model of disability wherein non-disabled people collect data but do not engage in disability culture or politics, emerging projects such as Mapping Access are making participatory access-making the basis of a kind of technoscientific "access intimacy" (Mingus, 2017) through practices such as "critical crowdsourcing" of accessibility data (Hamraie, 2018). Rather than simply creating functional maps, Mapping Access focuses on mapping as a tool for producing critical relations between bodies, environments, and technologies. At collective map-a-thons, the project enrolls disabled and non-disabled data collectors in the process of interrogating the messiness of access-making in institutional conditions and describing these conditions collectively. Critical crowdsourcing practices include enrolling large numbers of both disabled and non-disabled people to collaborate on surveying and describing building accessibility while simultaneously identifying the aspects of the Americans with Disabilities Act compliance that fail to consider the lived experience of accessibility. Collaborative mapping visualizes the evidence of inaccessibility while creating opportunities for collective response. Crip cartographic technoscience thus enables more critical design, and interrogation of the everyday built environment.

Our call for crip technoscience theory and practice holds in tension Kafer's crip politics of interdependence with the crip ambivalence toward

technology. We follow Kafer by calling on the usefulness of the cyborg (and the technoscientific circuits it embodies) not as a disabled figure per se, but as a tool for "stag[ing] our own blasphemous interventions in feminist theory" (Kafer, 2013, p. 106). Crip technoscience borrows the tools of feminist hacking and coding to blaspheme against liberal theories of disability rights and rehabilitation imperatives, as well as against the technological essentialisms of disability scholarship. While disability technoscience is often deployed for unwanted cures or enhancements, we contend that it can also be cripped, reclaimed, hacked, and tinkered with to create a more accessible world.

Crip technoscience is committed to disability justice. Crip technoscience aligns with the disability justice movement, with its critique of mainstream disability rights concepts, and its focus on intersectionality, collective liberation, and wholeness. Crip technoscience emphasizes that disabled people are not mere consumers of, or objects for, assimilationist technologies, but instead have agential, politicized, and transformative relationships to technoscience. We note that (as a matter of disability justice) disabled people often reject devices that cause pain or lead to infections, refuse pharmaceutical drugs with undesirable effects, discard technologies produced solely to make non-disabled people more comfortable (rather than to make life easier for disabled people), problematize expensive tools crafted by the medical and military-industrial complex, and instead demand more public, widespread forms of access. These critiques and practices align crip technoscience with impurity (Shotwell, 2016), embracing the ugly (Mingus, 2011), and staying with the trouble (Haraway, 2016).

While we write from our position as English-speaking, North American, settler and immigrant scholars and makers, we commit to crip technoscience that centers the leadership of those most impacted, including the expertise of black, brown, and Indigenous disabled people. We call for a crip technoscience that disrupts the entitlements of whiteness and colonialism in designed spaces and highlights access as a frictioned project requiring decolonization and racial justice. We imagine disability justice-

informed crip technoscience as building upon projects such as "Open in Case of Emergency," a 2017 issue of the *Asian American Literary Review* edited by Mimi Khuc, which uses print culture, images, and symbolic imaginaries to hack the *Diagnostic and Statistical Manual (DSM)*. This interactive project draws upon familiar technoscientific objects (such as the *DSM*), as well as poetry, tarot, and hacked science, to work through Asian American intergenerational trauma and displacement. We also imagine crip technoscience allying with emerging work in feminist of color technoscience, such as a recent *Catalyst* "Lab Meeting" on Black Lives Matter and pedagogy that describes possibilities for extending critical ideas about race, intersectionality, and the environmental construction of health to rehabilitation, immunology, and mental disability (Pollock & Roy, 2017). Crip technoscience is not only in alliance with these projects, but takes the position that they ought to be central to how we imagine accessible futures.

In committing to disability justice, crip technoscience explicitly engages the tensions that arise out of taking disabled bodies to be whole, railing against the ways that we are assumed to be damaged, tragic, or in need of cure. To approach disabled bodies by way of wholeness marks the importance of collective, relational, and interdependent approaches to disability. Following Eli Clare, we crip wholeness to include "that which is collapsed, crushed, or shattered" (2017, p. 158), emphasizing that whole and broken are not opposites but rather can be held in productive tension. Following a disability justice framework, marking disabled people as whole is to "value our people as they are, for who they are, and understand that people have inherent worth outside of capitalist notions of productivity" (Berne & Sins Invalid, 2016, p. 17). Taking up wholeness in this way also addresses the complexity of wanting to both accept disabled bodies as they are while simultaneously desiring to hack, tweak, and otherwise engage and alter our relationships to our bodies and technology. As Clare asks, "How can I reconcile my lifelong struggle to love my disabled self exactly as it is with my use of medical technology to reshape my gendered and sexed body-mind?" (2017, p. 175). Crip technoscience embraces this contradiction, making space for critically engaging technological

intervention while maintaining that such interventions are not compulsory.

We find inspiration for crip technoscience and disability justice within what Alice Sheppard (2019) calls "cultural-aesthetic technoscience," particularly the ways that disability artistry, performance, and media explore the complexities of wholeness, seeking neither to overcome disability nor lapsing into a celebration of individual difference in and of itself. For example, Sins Invalid, a performance collective led by queer and disabled people of color, uses live and video performances, along with publications, to convey alternatives to disability rights perspectives centered on assimilation. In their performances, which feature people who use assistive devices such as canes, power wheelchairs, and crutches, Deaf people, amputees, and people with non-apparent disabilities, "normative paradigms of 'normal' and 'sexy' are challenged, offering instead a vision of beauty and sexuality inclusive of all individuals and communities" (Sins Invalid, 2018). In their publication *Skin, Tooth, and Bone* (2016), the collective outlines a framework for disability justice organizing that draws on performance and activist work made possible through technology.

Similarly, the Canadian disability arts organization Collaborative Radically Integrated Performers Society in Edmonton (CRIPSiE, 2018) challenges "dominant stories of disability and other forms of oppression, through high-quality crip and mad performance art, video art, and public education and outreach programs" that "celebrate the generative possibilities of 'disability' and 'mental illness,' in terms of how these experiences can offer important alternative perspectives." In the dance-based video-art project *Other-wise*, Danielle Peers and Lindsey Eales (2013) explore themes of interdependency, access, and wholeness, speaking the movements of their dance as Peers's and Eales's bodies move toward and away from each other, limbs entangling over and around Peers's wheelchair: "Lifts. Supports. Draws me out and pulls me in. Connects…*We* are the chair…We will not overcome, but we are becoming." Performative uses of technology transform the meaning of functional technology from rehabilitative or adaptive to cultural.

Another site of crip technoscience world-remaking is disability

fashion. For example, Chun-Shan Sandie Yi's Crip Couture project (2017) creates wearable art, tailor-made prosthetics, and orthotics to highlight difference and disability. Yi works with unconventional materials, including skin and hair, to engage the contradictions of disability wholeness. Designer James Shutt's Myostomy project likewise offers lingerie-inspired stoma plugs for colostomy bag users, as well as body art products that aestheticize the stoma (London, 2012). Like Yi's work, these interventions transform the typical understanding of assistive technology, rendering it as crip fashion, art, and culture.

Crip media production is also a tool for producing new representations of disability that challenge disability technoscience discourses. For example, disabled artist Sue Austin developed a wheelchair that allows her to dive underwater. Documenting these experiences in the ocean's depths, surrounded by blue water and oceanic creatures, Austin highlights the joy and freedom of "revisioning the familiar" (2012) by using a wheelchair to negotiate unexpected worlds. Appearing in the disability and technology documentary *Fixed* (2014) directed by Regan Brashear, Austin's work offers ways of "seeing, being, and knowing" *with* disability that affirms crip world-remaking (Austin, 2012).

In the digital age, YouTube and other online services have become tools for distributing disability justice content. Autistic activist Mel Baggs's manifesto, "In My Language" (2007) (viewed over 1.5 million times as of this writing), uses video and sound to make a strong case for the dignity and personhood of Autistic people. In a series of clips, Baggs makes sounds, touches objects, and uses their body to move through space. Later, Baggs shows the same clips with a computer-generated voiceover explaining that moving and feeling are a language. Because "the way [Baggs] naturally thinks and responds to things looks and feels so different from standard concepts," "some people do not consider it thought at all, but it is a way of thinking in its own right." Instead, Baggs advocates for the agency and power of Autistic people, particularly non-speaking people, who are often excluded from mainstream disability narratives.

While recognizing the inequitable ways in which many people come

to disability, crip technoscience claims disabled life as desirable life, as life worth living, and as a difference that matters. Disability rights often foreground a pride-centered framework without acknowledging the relationships between pride and "the violence of social/economic conditions of capitalism" (Erevelles, 2011, p. 17). Crip technoscience acknowledges that that pride-centric frameworks may make it "difficult to acknowledge the overwhelming suffering that results from colonisation, war, famine, and poverty" (Meekosha, 2011, p. 677), such that it becomes crucial to reject "the ways in which disability is presently employed as a mechanism for oppression in the global context" (Jaffee, 2016, p. 118). Within such contexts, "positive re-envisionings of disability" are not always politically salient (Puar, 2017, p. xix). Building on disability justice, however, crip technoscience centers the transformative role of disabled people in both technoscientific and activist conditions to both build and dismantle the world toward more just social relations, which includes engaging the "specific sensibilities and discourses" (Ben-Moshe, 2018) that disability culture offers to refute disability "as a vector of social control" or "a weapon of debilitation" (Fritsch & McGuire, in press). Following Clare, we ask, "how do we witness, name, and resist the injustices that reshape and damage all kinds of body-minds—plant and animal, organic and inorganic, nonhuman and human—while not equating disability with injustice?" (2017, p. 56). This question acknowledges the messiness of access-making in conditions shaped by colonialism, militarism, and injustice, but also asks us to go further and locate the conditions and transformative power of crip knowing-making under these systems.

Disabled people use technoscience to survive and alter the very systems that produce disability or attempt to render us as broken. Take the example of Safwan Harb, a disabled Syrian refugee with two disabled family members (British Broadcasting Corporation [BBC], 2016). While living in a refugee camp, Harb designed an accessible scooter using found materials, which enabled him and other family members to navigate the camp's unpaved streets. Harb's invention signifies crip knowing-making in spaces produced through war and displacement. Mobility, in this context, is not a

tool for reinforcing ablenationalism, productivity, or even rights. But Harb's invention *is* an outcome of a design process enacted through crip experience. Crip technoscience recognizes the non-innocent contexts in which knowledge and access emerge. In some cases, crip technoscience may be an individual knowing and making that reorients the material world. In others, it may be collective, politicized work toward interdependence and justice. Building on Haraway, we offer crip technoscience as a critical project that holds in tension the unjust imperatives of technoscientific innovation with the transformative capacities to shape matter and meaning through praxis. The point is not to achieve ideological purity outside of mainstream disability technoscience, militarism, or capitalism, but to locate and center threads of resistance already occurring within and against these systems.

As technoscience expands beyond Cold War–era emphases on militarism to include conditions often deemed innocent or uncontroversial (such as sustainability), disabled people are often caught between imperatives to save resources and enable access (a conflict most recently highlighted by the #StrawBan debate discussed in Alice Wong's piece in this issue). But crip technoscience can offer us a sensibility and set of practices for responding to collective problems such as climate change and pollution. Not only do disabled people act as experts and designers in matters of how to reduce single-use plastics such as straws, but we can also draw on our community-generated accessibility and Universal Design practices to shape responses to the Anthropocene. For example, recent studies estimate that volatile organic chemicals (VOCs) in fragranced beauty products and aerosol sprays produce more $C0_2$ emissions than cars (McDonald et al., 2018). Disabled people with chemical sensitivities or injuries have long advocated for fragrance-free spaces to avoid migraines, brain fog, and illness, in addition to calling for reduced industrial pollution. Activists such as Piepzna-Samarasinha (2018) have not only offered education about fragrance accessibility, but also hacked the production of fragrance-free products. Following Piepzna-Samarasinha, who describes accessibility as an "act of love" (2018, p. 74), crip technoscience imagines the hacking of non-harmful resource use as an act of planetary love through

which accessibility for marginalized disabled and chemically injured people can also mitigate chemical harm toward the atmosphere and oceans. These opportunities for hacking and tinkering with pervasive practices such as VOC use also show us that crip expertise and ingenuity need not rely on disability pride narratives to challenge global conditions harming human and non-human life. In drawing on disability justice principles, crip technoscience agitates against compulsory ablebodiedness and ablenationalism, and mandates for independence and productivity. It works on multiple scales—from the most basic everyday hacks to organized efforts toward collective access—to materialize accessible futures as those in which bodies need not be perceived as productive, legible, articulate, or beautiful to be understood as important agents of world remaking.

Conclusion

Crip technoscience spans historical and contemporary design practices, political activism, scholarly alliances, global systems, and micro-scale resistances. We call for crip technoscience practices that challenge the political economy of technology, particularly as it is ensnared within injustices perpetrated by imperatives to fix, cure, or eliminate disability.

Crip technoscience struggles for futures in which disability is anticipated and welcomed, and in which all disabled people thrive, regardless of their productivity. By endorsing accessible futures, we refuse to treat access as an issue of technical compliance or rehabilitation, as a simple technological fix, or a checklist. Instead, we define access as collective, messy, experimental, frictional, and generative. Accessible futures require our interdependence.

We center technoscientific activism and critical design practices rooted in disability justice, collective access, and collective transformation toward more socially just disability relations. We call for activists, scholars, and makers to expand possible futures for disabled people. We find crip knowing-making in the design and implementation of architectures, technologies, and infrastructures. We seek broad recognition for, and

engagement with, the world-building and -dismantling force of crip technoscience.

Notes

[1] Earlier work defined crip technoscience as "experimental practices of knowing-making [that] challenged hierarchies and power relations…by shifting expertise to those with lived experiences of disability and away from the outside experts often designing in their name" (Hamraie, 2017, p. 99) and "technoscientific practices…that politicize disabled people's relationships to technologies produced by the military or pharmaceutical companies, while valuing the technoscientific activism that has characterized disability rights history" (Hamraie, 2015, p. 309).

[2] Liberation technoscience projects have included Black Panther health activism (see Nelson, 2013); feminist reproductive technoscience (see Murphy, 2012); ACT UP protests against the US Food and Drug Administration (see Epstein, 1996); and the Independent Living movement's accessibility activism (see Williamson, 2012a, 2012b). Crip technoscience connects to historical activism and scholarship while offering a politicized, anti-assimilationist lens for understanding disability in relation to technology.

[3] There are, of course, also histories of engagement between disability studies (particularly scholarship on embodiment and culture) and critical approaches to science, technology, and medicine. See Casper and Koenig (1996); Mills (2011); Ott, Serlin, & Mihm (2002); Sobchack (2006); and Sterne (2001). However, we concur with Stuart Blume, Vasilis Galis, and Andrés Valderrama Pineda, who write, "The challenging questions that disability raises for STS go beyond those relating to the politics of technological change to include questions relating to knowing, to knowledge production, and in particular to embodiment" (2013, p. 102). Crip technoscience turns to these questions of knowing, making, and doing.

[4] "New telethon" references the rehabilitation-centered media events hosted by the late Jerry Lewis that have been widely contested by disability activists and scholars. See Longmore (2015).

[5] Veteran activism has frequently involved mobility devices. In the 1978 film *Coming Home*, a paralyzed veteran chained himself and his

wheelchair to the front gates of a military base in protest of the war and high rates of veteran suicide. While depicting a radical disability protest, however, the opening screening of the film was held at an inaccessible theater in San Francisco. In response, disability activists chained themselves to the front of the building in protest (Linton, 2007). Similar tactics were used in anti-war and anti-nuclear protests in the 1970s and 1980s (A. Finger, personal communication, 2018) and in protest of the War on Terror (Ollis, 2012). Most recently, ADAPT activists in the United States have used their mobility and assistive devices to protest cuts to healthcare, staging "die-ins" at US Senate Healthcare policy deliberation meetings (McBride, 2017).

[6] As disability justice activists point out, disability rights approaches are often focused on assimilation into middle-class, white, productive, heteronormative norms. Additionally, disability rights are often enforced through "accommodations" that integrate disabled people into mainstream society using standardized formulas and checklists. We find this focus on accommodation to be depoliticizing. Crip technoscience pivots instead on friction and protest as accessible world-making.

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Bios

Aimi Hamraie is Assistant Professor of Medicine, Health, & Society and American Studies at Vanderbilt University (Nashville, TN). Their interdisciplinary research spans disability and feminist theory, architecture and design, and science and technology studies. Hamraie is the author of *Building Access: Universal Design and the Politics of Disability* (University of Minnesota Press, 2017). Hamraie also directs the Critical Design Lab, a multi-institution project focused on disability, design justice, and the lifeworld.

Kelly Fritsch is an Assistant Professor in the Department of Sociology and Anthropology at Carleton University in Algonquin Territory (Ottawa, Canada). Her research broadly engages crip, queer, and feminist theory to

explore the relations of disability, health, technology, risk, accessibility, and social justice. She is co-editor of *Keywords for Radicals: The Contested Vocabulary of Late-Capitalist Struggle* (2016, AK Press) and was a 2015-2018 Banting Postdoctoral Fellow at the Women & Gender Studies Institute, University of Toronto.