Crip Reflections on Designing with Plants: Intersecting Disability Theory, Chronic Illness, and More-than-Human Design*

Sylvia Janicki
Georgia Institute of Technology
Atlanta, Georgia, USA
sjanicki3@gatech.edu

Nassim Parvin
University of Washington
Seattle, Washington, USA
nassimi@uw.edu

Noura Howell
Georgia Institute of Technology
Atlanta, Georgia, USA
nhowell8@gatech.edu

ABSTRACT

Through an autoethnographic account of designing, exhibiting, and maintaining an interactive bioart installation with plants, we trace intersections between more-than-human design, disability theory, and lived experiences of chronic illness. Specifically, we deconstruct three "polished" exhibits of our installation through stories of breakdowns and failures, organized in three main themes: maintenance and care, buggy biodata, and collective resistance to purification and control. Our reflections show how plants, technologies, and a chronically ill body became entangled with each other conceptually and materially, surfacing new sites for more-than-human relationalities. In our discussion, we unpack how disability perspectives can expand more-than-human design practices, highlight opportunities for re-imagining exhibition spaces, and offer adaptation as a strategy for design in HCI.

CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**.

KEYWORDS

more-than-human design, disability theory, chronic illness, autoethnography

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1 INTRODUCTION

This paper unpacks our process of designing, maintaining, and exhibiting an interactive bioart installation, *Sensing Bodies: Being, Feeling, and Breathing with Plants*, specifically through a disability lens. Through an autoethnographic account by the first author (from here out A1), we trace intersections between more-than-human design, disability scholarship, and lived experiences of chronic illness. More-than-human design in HCI foregrounds multi-species perspectives and collaborations that decenter the human, especially in the context of environmental problems [94]. More recently, more-than-human projects in HCI have also begun to engage with critical and postcolonial perspectives [7, 54, 61]. Here, we contribute a disability perspective to more-than-human design.

As an art installation, *Sensing Bodies* engages with the colonial histories of plants. The installation integrates plants, biosensors, data displays, and tangible embodied interaction design to highlight reciprocal people-plant relationships and facilitate reflections on socio-political entanglements with more-than-humans. Using a modular design approach, we have exhibited *Sensing Bodies* in three different geographical locations, Atlanta, Georgia, USA; Puebla, Mexico; and London, England. Each exhibit engaged with a unique postcolonial theme and a distinctive set of plants with specific connections to local histories.

In this paper, we draw from autoethnographic field notes to unpack stories and lessons learned from working on these exhibits over two years, especially highlighting disability perspectives. Namely, A1, who led the design, coordination, and care for each of these exhibits, lives with a chronic illness. As such, her illness experiences are interwoven through these more-than-human material engagements and reflections on design processes. Through this study, we investigate: What new insights or strategies might we learn from disability perspectives in designing more-than-human interactions? In our findings, we describe what went into our "polished" exhibits through stories of breakdowns and failures. Specifically, we discuss the acts of maintenance and repair that went into caring for the plants, technologies, and a chronically ill body; we share accounts of glitchy human-plant interactions that revealed unchecked assumptions in our design with biodata; and lastly, we highlight how our more-than-human installation resisted practices of purification and control to reveal messy multi-species ecologies. In our discussion, we unpack what disability perspectives on more-than-human interactions can offer design practices in HCI, explore possibilities for more inclusive practices in exhibition spaces, and offer adaptation as a strategy for working through tensions in more-than-human design and beyond.

2 RELATED WORK

2.1 More-than-Human Design in HCI

In HCI, more-than-human design has largely focused on re-orienting human exceptionalism toward non-human perspectives to address environmental problems and work toward sustainable futures [94], especially in the context of the Anthropocene [15]. Much of more-than-human scholarship in HCI leans on posthumanist theory, a

*Crip is a term reclaimed by disability scholars and activists to denote a sense of pride and identity in disability experiences, challenging traditional, ableist perceptions of disability.

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Figure 1: Three displays of *Sensing Bodies* shown in three different international exhibits: Left: *Being with Plants* featuring indigo plants at the exhibit in Georgia, USA. Middle: *Feeling with Plants* with scarlet sage at the exhibit in Puebla, Mexico. Right: *Breathing with Plants* featuring fennel plants at the exhibit in London, England

philosophical perspective that sees people as entangled within complex more-than-human systems, including technologies and other organisms [10]. More-than-human design also draws from concepts in feminist science and technologies studies (STS), such as the idea of naturecultures, denoting interwoven and interdependent relationships between human and more-than-human worlds [34, 93]. This growing area of work emerges alongside a relational turn in HCI that reflects the co-constitutive relationalities between humans and non-humans [39] and foregrounds bodies themselves as more-than-human [40]. Subsequently, HCI scholars have enlisted different organisms as design and research partners to design with and for more-than-human worlds [1, 37, 73, 94]. These include bacteria [4, 38, 74], fungi [65, 68], animals [8, 11], and plants [26, 72, 77, 91].

In thinking through how our bodies are entwined with more-than-human ecologies, we specifically highlight HCI design projects that engage with multi-species bodily entanglements and interdependence. For example, Helms explores designs for leaky breastfeeding bodies that reflect on more-than-human exchanges of physical matter, including with bacteria [38]; Søndergaard and Woytuk explore designs for menstrual care for more-than-human bodies through moss [84]. Liu et al. share a framework alternative to the control paradigm to work with nature instead of against it, drawing on permaculture ethics of interdependence [66]. These projects contribute important perspectives on designing for more-than-human worlds.

However, post-anthropocentric projects in HCI have at times been critiqued for their reliance on western philosophies, despite many of their core ideas being derived from Indigenous and non-western worldviews [89]. Critical race scholars have also highlighted that many posthumanist and more-than-human projects flatten human differences and universalize complex and situated human-non-human relationships [16, 47, 50]. In response, HCI scholars have begun to emphasize more critical perspectives in more-than-human engagements, including reflections on their sociopolitical significance. For example, Biggs et al. examine environmental tensions by engaging with intersections of racial histories and sustainability [7]; Kay et al. bridge feminist ethics of care with Indigenous Ecological Knowledge in unpacking tensions of posthumanist HCI [61].

In the design of *Sensing Bodies*, we especially highlighted non-western scholarship on more-than-human relationships. These include Indigenous perspectives on plants and land practices, which have long engaged with ideas of more-than-human interdependence [25, 62, 64], as well as critical race scholarship that calls for more-than-human research to recognize colonial and racial politics [16, 47, 71], foregrounding the ongoing impact of colonial histories on environmental problems. We share more on our installation design that highlights these perspectives in section 3. We also described this in more detail in our previous publication, which focused on the design of *Sensing Bodies* [54].

2.2 Disability Studies and the Environment

In this paper, we bring another perspective to more-than-human design, specifically, a disability perspective. Although more-than-human scholarship in HCI has rarely engaged with disability perspectives, these connections have been explored to some extent by critical disability scholars. We bring this literature to HCI to highlight intersections between disability experiences and more-than-human design spaces, which we draw from to inform our analysis.

Disability scholar Alison Kafer suggests that "the experience of illness and disability presents alternative ways of understanding ourselves in relation to the environment, understandings which

can generate new possibilities for intellectual connections and activist coalitions" [59, p204]. These alternative understandings and relations have been expressed by different disability communities. For example, Manning and Massumi describe how neurodivergent people relate differently to more-than-humans, like birds, because they often have a different set of perceptual expectations [69]. Similarly, chronic and environmental illness communities have often described themselves as "human sensors" [56], with an acuity toward environmental toxins and sensitivities to sensory stimulation. Below, we highlight three areas of intersections between disability writings and environmental concepts: through transcorporeal material entanglements, emphasis on radical care and interdependence, and critiques on practices of purification.

2.2.1 Transcorporeal Material Entanglements. STS scholar Stacy Alaimo introduces transcorporeality as a paradigm that interconnects human bodies and the environment through interchanges and interconnections between various bodily natures [2]. These material exchanges across human and non-human bodies are often seen in chronic illness narratives. For example, Mel Chen discusses their past exposure to lead and resulting sensitivity to environmental toxins as the basis for reflections on "chemical animacies", describing chemicals as more than inert substances that move through and interact with bodies and environments [14]. Hsuan Hsu describes the "atmospheric vigilance" and "environmental choreography" required of people who live with multiple chemical sensitivity (MCS), a condition characterized by hypersensitivity to toxic particles, including more-than-human organisms like mold [45]. Sophia Jaworski writes about the "chemical intimacies" of everyday toxic exposures in the lives of people with MCS [55], mobilizing the more-than-human metaphor of the canary in the coal mine to foreground entwined colonial and ableist logics in experimental subjecthood [56]. These narratives highlight more-than-human entanglements in chronic illness experiences both materially and conceptually, reinforcing posthumanist ideas of our more-than-human relational co-constitution. They further demonstrate how experiences of illness and disability are deeply connected to issues of environmental justice, reflecting postcolonial perspectives on the environment.

2.2.2 Radical Care and Interdependence. Disability writings also echo ecological ideas of interdependence. In unpacking the term "crip ecologies," Cachia explains that both disability studies and environmental studies emphasize how "the essential practice of radical care for one another, our animals, and the resources on our planet is an act of solidarity, cooperation and co-responsibility," suggesting that "the body-minds of disabled folks and the environment are inherently interdependent" [13].

In ecology, interdependence describes mutual reliance between organisms and their broader ecological community. In many Indigenous world views, this idea is extended to recognize human interdependence and reciprocity with more-than-human worlds, including in social and spiritual ways [16, 24, 62]. In critical disability studies, interdependence has been described as an ideal and a political technology for access [33]. Hamraie suggests that the "fundamental interdependence of all bodies for sustenance, community, and care" is often ignored in western technocentric ideals of access that prioritize independence, which can perpetuate harm against marginalized people [31]. Instead, interdependence as an ideal recognizes access as relational, created through relationships between people, technologies, and their environments [6]. These connections are reinforced in feminist ethics of care. In their influential essay, Fisher and Tronto suggest that "care is everything that we do to maintain, continue, and repair 'the world' so that we can live in it as well as possible. That world includes our bodies, ourselves, and our environment, all that we seek to interweave in a complex, life-sustaining web" [21, p.42]. Collectively, these works suggest that the wellbeing of individual bodies are inseparable from their surrounding environment and relationships to others.

2.2.3 Critiques on Purification Practices. As disability writings embrace our interdependent more-than-human relationships, they also resist discourses and practices of purification that focus on clearing out bugs, weeds, or other impurities in land or human bodies.

In particular, disability scholars have broadly criticized purification practices in modern medicine, including their solutionist and universalist approaches of "fixing" disability, "cleaning out" illnesses, and solving the "problems" in these bodies [58, 79]. In her article "I Will Not Be Purified," disability artist and activist Sophy Strand articulates the violent acts of purification in treatments of certain chronic illnesses, describing how our embodied ecologies are deeply entwined with environmental concepts of diversity: "Pathogens, it turns out, often constitute health. Soil without a microbial and fungal biome cannot sequester carbon, cannot grow nutritious food, and cannot, ultimately, support any life at all…This dualism is remarkably incompatible with the biodiversity of healthy ecosystems. And, worse, it lacks compassion for the ill, the bereaved, and survivors of abuse" [87]. These harmful and reductive purifying practices ignore the nuance and intricacies of multi-species interdependence.

In "Against Purity," Alexis Shotwell describes purity discourses as products of "a certain formulation of modernity" [82, p.14] that have fueled colonial projects, driven genocidal and ecologically harmful understandings of medicine and technology, and contributed toward an array of other problems in the Anthropocene. Connecting this to chronic illness, Shotwell shares a historical account of the biomedical classification of AIDS, describing how its "purified" narrative reduced the complexity and plural experiences of the illness, omitting, and thereby inflicting harm on many people who were afflicted, especially women.

Along these lines, many disability writings have problematized medical classifications as a practice of "purifying" complex bodily conditions often manifested in chronic illnesses. Bowker and Star suggest that chronic illness experiences disrupts categories constructed "in the acute world of allopathic medicine" [9, p.9]. These chronic conditions often evade detection through standard medical practices or diagnostic tools, and resist simple "cures" through their chronicity and complexity, revealing shortcomings in dominant medical approaches.

These examples bridge ecological concepts to embodied experiences of illness, foregrounding the messy multi-species ecologies in both human and land bodies. In our analysis, we draw from these ideas to connect more-than-human design to disability perspectives.

3 DESIGN AND EXHIBITS

Sensing Bodies is an interactive installation that integrates plants, biosensors, and LED data displays in a series of tangible embodied interactions to facilitate reflections on our sociopolitical entanglements with plants. The project has been exhibited in three international locations over the past two years. In each exhibit, we feature specific plants with connections to the local landscape where the exhibit is held or to the broader theme of the event. Alongside the displays, we present narratives of each plant to share their connections to colonial histories, highlighting more-than-human relationships through a postcolonial lens.

3.1 Design and Interactions

Each installation of *Sensing Bodies* features two or three of the following displays, depending on the setup: *Being with Plants, Feeling with Plants, and Breathing with Plants* (see fig1). Each display features a unique plant inside a plexiglass box. The plexiglass boxes are lined with two-way mirrors on the front and back and LED strip lights along their sides. A unique sensor is connected to or placed adjacent to each plant, capturing the embodied interaction between the plant and interacting participant. We use LED lights to display the biodata representing this human-plant interaction and pair specific sensors with each plant based on their unique qualities to highlight sensory experiences through embodied connections. Specifically, in *Being with Plants*, we use a depth sensor to draw the participants toward the plant and its embodied history, triggering LED lights to brighten as a participant approaches and dim as they recede. In *Feeling with Plants*, we use an EMG or touch sensor to invite participants to touch the plant, which triggers changes in the hues and brightness of the LED display. The gesture of touch probes a simultaneous intimacy and reflection on the violent physical contact with plants in historical colonial practices. In *Breathing with Plants*, we use an oxygen sensor to encourage participants to breathe with and smell the plants. The interaction blurs the boundaries between bodies and environments, triggering a rainbow-colored display upon the detection of a human breath.

Together, the sensors, LED lights, and two-way mirrors create a human-plant interface that displays shifting perspectives based on the biodata input: Generally, when lights are off, one sees their own reflection; when lights are dim, one sees a merging of their reflection with the plants within; when lights are bright, one sees only the plant within, losing sight of their own reflection. This creates a visual experiences of "becoming with plants."

3.2 Exhibits in Three Locations

Sensing Bodies has been exhibited in three international locations. Most recently, it was featured in a three-month long exhibit as part of a curated group art show in Atlanta, Georgia, USA, with a general theme focused on sustainability. In this exhibit, we featured three plantation plants from Georgia, indigo, tobacco, and rice, to reflect on the more-than-human entanglements on plantation landscapes in colonial histories of the American South. All the plants for this exhibit were grown by seed by A1 over the course of several months prior to the exhibition. In our analysis, we especially focus on reflections from this extended exhibit.

Sensing Bodies was also displayed in a 3-day long demo at a conference that took place in Puebla, Mexico. In this exhibit, we spotlighted plants entangled with colonial extractions of local forest ecologies and included a reflection on invasive and native plants. We worked with a local ethnobotanist to acquire and showcase two plants: the chocolate cosmos, a local plant with a chocolate-like scent originally "native" to forests of Mexico but now extinct in the wild (featured in *Breathing with Plants*), and scarlet sage, a non-native plant classified as "invasive" in some places but often cultivated for its aesthetic qualities and used for its medicinal benefits (featured in *Feeling with Plants*).

Finally, *Sensing Bodies* was exhibited in London, England in a one-day event focused on themes of reproduction. The event was a gathering of humanities scholars, activists, artists, and practitioners working in the fields of reproductive justice. In this exhibit, we featured herbal medicinal plants used in traditional medicines for healing women's bodies. Specifically, the exhibit featured celosia, an emmenogogue that supports menstruation by stimulating blood-flow in the pelvic area, and fennel, a galactagogue that supports lactation for breastfeeding. We worked with local reproductive scholars in London to select and acquire these plants from local nurseries.

4 METHODOLOGY

We have previously examined *Sensing Bodies* as an artifact by sharing our design process and participant interactions [54]. In this paper, we use autoethnography as a research method to trace intersections between disability theories, experiences of chronic illness, and more-than-human design. Specifically, we draw from A1's experience of designing with plants through her perspective of living with chronic illness.

4.1 Autoethnography in HCI

We follow a growing body of work in HCI that employs first-person methods to study and draw insight from personal experiences [17]. Many autoethnographies in HCI have offered new understandings from underrepresented perspectives or areas of study. These include disability perspectives [52, 53] and queer perspectives on technologies [63, 85], studies that engage with intimate bodily experiences, such as breastfeeding [38], childbirth [28], masturbation [46], and menstruation [41], as well as reflections on vulnerable or difficult experiences [18, 43]. First person methods have further explored relationships to more-than-humans (e.g. [8, 38]). We build on these studies to employ autoethnography as a form of inquiry and reflexive practice that teases out new ways of relating to the self and other, including other organisms and technologies.

4.2 Data Collection and Analysis

In our autoethnography, we draw from A1's documentation of *Sensing Bodies*, including photographs, videos, and field notes in the form of written journal entries. Specifically, A1 kept a journal throughout the process of designing, facilitating, and maintaining each exhibit of *Sensing Bodies* that describe general observations, practices, interactions, conversations, and reflections. In addition to reflecting on the installation, in the field notes, A1 also reflected on her own body, especially in the context of coping with tensions

of chronic illness while engaging with the project. Following Biggs et al. [8], we use A1's autoethnographic practice both as a method of reflection and analysis. We conducted a close reading of our collective textual and visual data, including roughly 70 pages of written journal entries. We annotated and highlighted our field notes and photographs, marking significant events and encounters, and reflexively examined lessons learned from the process. We outlined and grouped data into related themes, and iteratively refined the themes.

In our analysis, we explicitly bring in a disability lens into the reading of our data, using disability writings to make connections between more-than-human design processes and chronic illness experiences, as documented by A1. Disability theory has been a critical part of A1's scholarly practice and served an integral role in the organization and categorization of our data. Specifically, we use theoretical concepts from disability scholarship as lenses to organize our themes and subthemes, integrating these concepts into the writing of our findings section. Throughout our analysis process, we alternated between reading theory and analyzing data. A1 discussed and processed findings with A3 to refine and iterate on themes. Through our iterative analysis, we noted that concepts related to breakdowns and failures emerged as an overarching theme and served to connect ideas between more-than-human interactions and experiences of chronic illness. We used it as a framework for further analysis, reflected in our findings.

4.3 Positionality

While this paper focuses on A1's perspective, A2 and A3 played important advising roles, mentoring A1 through the design of *Sensing Bodies* as well as supporting the research activities and theoretical understandings that we present in this paper. We share each of our positionalities here.

A1 is a cis woman from a culturally and racially mixed family and grew up in East Asia. For roughly ten years, A1 has lived with chronic illness. Through the years, she has learned to navigate through frequent symptoms in unpredictable "flares". Since beginning her PhD in the fields of design research and HCI, she has become deeply engaged with feminist and disability theories, which have shaped her design and research practices as well as understandings of her own illness. Prior to starting her PhD, A1 studied and practiced landscape architecture, which informs her interest in more-than-human design, especially with plants. A2 is an able-bodied cis-gender diasporic SWANA (Southwest Asian and North African) person living in exile. Her scholarship brings together design research and feminist STS. A2 brings a unique expertise in feminist and postcolonial theories into the project. A3 is a cis white middle-class woman with sensitivity to air quality that informs her interest in work on chronic illness. She comes from a family of multiple religions, nations, and cultures that contributes to her interest in postcoloniality.

5 FINDINGS

In this section, we tease out reflections from our experiences of designing and exhibiting *Sensing Bodies* over the course of two years. Specifically, our analysis surfaced important lessons from various moments of breakdowns that occurred behind our "polished" exhibits. STS and HCI scholars have described how failures and breakdowns illuminate the everyday work of maintenance, care, and repair [23, 48, 49, 70, 86]. They foreground "messy unfoldings" that disrupt linear success narratives [43] and offer lessons on design practice [29]. At the same time, they can also reveal structural assumptions and systemic biases [5, 78]. Our analysis surfaced how these disruptive incidents in unpredictable situations provided the critical moments of learning and new understandings while offering conceptual connections between disability experiences and more-than-human design. We share these stories in three main themes: First, we unpack the practices of maintenance and repair that went into caring for the plants, technologies, and A1's chronically ill body, surfacing questions of access in more-than-human design practices, especially in exhibition settings. Second, we describe how glitchy interactions with plants illuminated the situatedness of biodata readings, revealing unchecked assumptions in our design that echo feminist and disability writings. Third, we share how our more-than-human installation resisted acts of purification and control, revealing messy multi-species ecologies that reflect chronic illness experiences.

For each of the three main themes, we open with a short narrative of A1's experience with chronic illness that introduces the stories that follow. We further weave disability scholarship that informed our analysis process into the narratives throughout. For the rest of this section, we switch to a first person singular "I" to foreground A1's experiences and observations.

5.1 Maintenance and Care

Living with a chronic illness means that I have good days and bad days, but I need to put in a lot of work (with some luck) to have a good day: I have to eat the right foods, get a lot of sleep, not overexert myself physically, recover from treatments, avoid air-borne triggers... among other unaccountable things. One false move, and I could be engulfed in fatigue, inflammation, and malaise that may take days if not weeks to resolve. When this happens, I need a lot more rest and help from others. Chronic illness makes the labor of maintenance and care for the body very salient.

In the following accounts, I draw from literature on maintenance and repair alongside disability writings on care as access to unpack the entangled more-than-human maintenance and care practices shared between plants, technologies, and a chronically ill body. Specifically, I recount the acts of maintenance for installations of *Sensing Bodies* and how it affected my own body. I reflect on ableist expectations ingrained in making practices and exhibition culture and tensions of participating as a graduate student with a chronic illness. Along the way, I enlisted others to care for the project with me, and in turn, they also cared for me.

5.1.1 *Maintaining Plants, Electronics, and a Chronically Ill Body.*

In *Sensing Bodies'* exhibitions, extensive maintenance and care for the installation and for myself became a balancing act. The project demanded a lot of labor in its construction and upkeep: Electronics need to be built and soldered; tangibles need to be laser cut and assembled; plants need to be grown and groomed; code needs to be written and debugged. Everything needs to come into relation - be connected, transplanted, calibrated. Then, things break down: wires

come loose, batteries run out, plants dry out, and the installation can easily fall apart. However, when these installations go on display as "finished" artifacts, the amount of physical and emotional work that goes into building and maintaining them can be easily obfuscated. In *Rethinking Repair*, Steven Jackson describes how engaging with technologies through breakdown, decay, and repair can highlight the importance of routine maintenance work in upholding stability [48]. Other scholars have also discussed how acts of maintenance reveal the social and relational practices around technology that resist their polished, purified, technocentric narratives of control [42, 86]. These ideas also apply to living things, such as plants and human bodies, especially one with chronic illness. Often, these acts of maintenance also include an affective dimension of care. However, throughout the exhibit, I had to learn to negotiate distances of care and prioritize who or what needed care.

For the three-month-long exhibit, I put a lot of work into growing the plants prior to their showcase. At the beginning of the show, I reflected on this process and my reluctance to leave the plants in the exhibit space unattended:

> "...moving their stems carefully, untangling leaves that have grown together, shifting each pot to capture sunlight throughout the day, spraying soap water to fend off gnats and white flies, observing new leaves come out...these daily acts of care involve so much physical and emotional labor and investment, that transplanting them into the hostile environment of plexiglass boxes in a dark space feels so wrong…"

This emotional attachment motivated me to commit extensive care for the installation. During the exhibit, I would visit the plants 2-3 times a week to water them. I regularly cleared them of gnats and mites by spraying soap water. I also programmed the Arduinos so that I could switch the LED lights from their colored data display mode to full spectrum white lights to serve as grow lights, since the plants had to stay in dark indoor spaces for three months. But I would only switch them on for a few hours at a time when the plants started to look a little depleted, so as not to overstimulate them. In addition, I also grew some "backup" plants at home, in case the plants in the displays wilted or died, to maintain a certain aesthetic in the exhibit. In retrospect, this showcase of "healthy" plants and discard of "sick" plants evoke some problematic ideals that parallel how we value able-bodiedness, concealing both the labor of care involved in sustaining health as well as the vulnerabilities fundamental to all living beings, all of which stood in conflict with my own illness narratives. I unpack this further in section 5.3.

Days after setting up the exhibit, I encountered the first breakdown when I noticed that the tobacco plant had wilted. I realized that the EMG sensor I had attached to its stem was emitting a little bit of voltage that was slowly burning the plant. This was distressing! I had invested months into growing these plants, *and* I needed this interaction to work for three more months. Eventually, I found a work-around: I re-positioned the sensor once to twice every week onto a "sacrificial" leaf, which would slowly wilt and die. However, the plant as a whole would survive, and new leaves would grow in the meantime. Here, again, some tensions between mechanical acts of maintenance and the emotional labor of care emerged. The situation calls to mind the violent and intrusive medical practices enacted on bodies through biomedical technologies, especially those with illnesses and disabilities [58, 79]. It further raises questions about the value assigned to different lives (or parts thereof) and how decisions are made regarding which lives (or parts) are deemed expendable for the greater good, reflecting ideas in disability justice [57, 81].

Beyond the plants, the electronics also required maintenance from the wear and tear of transporting, assembling, and people interacting with the installation. I had to re-solder LED light strips multiple times. I also had to re-cut plexiglass panels that were damaged or cracked from traveling. During the extended exhibit, I frequently adjusted the LED strip light casing that would come undone because the constant heat from the lights loosened its lining. At one point, I also noticed the oxygen sensor started to break down, displaying erratic colors.

These maintenance practices kept the installation running smoothly on the surface, disguising the many moments of uncertainties, anxieties, and breakdowns. This included the breakdown of my own body, the care of which sometimes conflicted with the labor required to keep the installation in working order. In *Maintaining, Repairing and Caring for the Multiple Subject*, Forlano describes how she cares for the technologies that keep her alive, suggesting that "Both the body and the technologies are in a constant state of change and deterioration. They are both, so to speak, disabled. At the same time, they are being maintained, repaired and cared for" [23]. While my relationship to this installation is in no way near the life or death situation that Forlano describes, it highlights the uncertainty and everyday-ness of negotiating distances of care. In my journal, I often described the bodily disruptions that stopped me from caring for the installation. For example:

> "I've been in a big flare and feeling super fatigued…lightheaded, out of breath, and inflamed…I was gonna try to go to Kendeda (the exhibition site) to check on the plants, but mid-way through walking there I decided to turn back because I felt like I didn't have enough energy to get there."

Often, I would feel too fatigued to get to the installation site. Other times, I would get there but feel depleted. However, the setup of the exhibition space allowed me to turn the occasion of caring for the plants into a form of self-care:

> "I like coming to Kendeda, especially when I'm feeling fatigued. They have these really nice chairs with headrests there that let me lay my head back when I'm feeling sick. I love those chairs. I like going there to rest with the plants and watch people interact with them."

I was grateful that the exhibit space was accessible and comfortable - it provided cushioned chairs with headrests that are surprisingly supportive (yet hard to come by in public spaces), especially when I was feeling unwell. This is not always the case. Focusing on accessibility was an intentional choice made by the curator of this event, and it was made possible with the help of other staff that collaborated on the exhibit. Disability artist and activist Shannon Finnegan has famously critiqued the inaccessibility of exhibition

Figure 2: Left: Tobacco leaves wilt from voltage emitted by the attached EMG sensor in *Feeling with Plants*. Middle: The oxygen sensor in *Breathing with Plants* sits on the soil amongst the rice blades. Right: A visitor sits in comfortable chairs with headrest in the exhibition space.

spaces, which often lack comfortable resting spots, requiring visitors to stand for extended amounts of time. In her installation piece, "Do You Want Us Here or Not," Finnegan painted chairs and benches with writings such as "This exhibition has asked me to stand for too long, sit if you agree" [20] and placed them in museums and art galleries. Her work makes visible the general lack of care in these spaces for people with different physical needs or stamina.

As the exhibit went on, I eventually had to step back from caring for the installation to prioritize care for myself. After a while, I began to spend less time and labor traveling to the exhibit site and monitoring the plants. Puig de la Bellacasa notes that "[care] can be about the right distance" [76, p.5]. Sometimes caring is about choosing not to care, reframing how to care, or rethinking who needs care. As a result, the plants began to slowly wither, revealing the labor of care it took to keep them healthy and disrupting the "polished" look of the exhibit, which I discuss in more detail in section 5.3.3.

5.1.2 Making and Exhibiting with a Chronic Illness. Reflections on maintenance and care for the exhibit surface some questions and assumptions about access. Overall, *Sensing Bodies* demanded extensive labor in its construction and upkeep. This is not surprising for an installation project, especially one with living materials. However, it does illuminate some assumptions about the physical ability required to participate in such making practices and exhibition spaces, generally speaking. Here, I outline some of the activities that impacted my body throughout the design process and exhibits of *Sensing Bodies* in ways that a "healthy" person may not have considered:

- The physical labor of installing could be difficult for me on a bad health day. Often I would need to rest intermittently or ask someone for help.
- Fumes of soldering and laser-cutting would sometimes leave me feeling sick for a few days, even with good ventilation.
- Traveling to display the project internationally was exciting, but often led to overexertion (I usually enlisted helpers - see 5.1.3).
- On a bad health day, just getting to local exhibit sites could be difficult (see 5.1.3)
- Growing outdoor plants inside my apartment led to the growth of soil molds that could have triggered symptoms.
- The unpredictability of having good days and bad days also made it difficult to commit to install and event dates or conference and talk schedules.

Admittedly, imagining specific accommodations for these situations is difficult and messy, especially with the many contingencies of a dynamic illness while accounting for the range of activities across different systems and spaces that go into this work. Instead, I did my best to navigate the tension between embracing opportunities for showcasing my work, especially as a graduate student eager to expand my networks, and balancing the needs of my body. HCI scholars have written about difficulties of navigating graduate school with a disability, especially in the context of accommodations [53, 88]. In their article, Jain et al. discussed situations in which their requested accommodations did not work, warranting the use of alternative coping strategies [53]. Similarly, I would often resort to coping strategies to adapt to my bodily needs. For example, in an unfamiliar place, I would scope out spaces for quiet resting spots and find out where the nearest restrooms are; I always made sure my husband knew where I was in case I needed help getting home; and I always carried some essential items that could help manage symptoms in case of a sudden flare - water, ibuprofen, some food, cough drops, and menthol ointments. In addition to

the difficulties of articulating specific accommodations, I also felt that demanding them could be seen as needy, inflexible, or flaky, especially when my illness is dynamic and invisible. In "Building Access," Hamraie discusses how traditional approaches to accessibility, including requesting accommodations, often places the onus on individuals with disabilities, thereby perpetuating ableist norms [32]. In practice, access is messy, like illnesses and disabilities themselves, entangled with dynamic environments, relational practices, and sociocultural expectations.

5.1.3 Care as Access. Instead of requesting accommodations, I usually enlisted others for support. Throughout the course of *Sensing Bodies*, I relied on many people to care for me while I cared for the project. For example, my husband gave me rides to and from the exhibition sites when I was too tired to get there on my own, helped me carry, move and assemble different pieces of the project, and took care of the plants at home prior to the exhibit while I was away. In addition, knowing I may have issues with exertion from traveling, my sister-in-law (who lives in Mexico) stayed with me during my week-long conference in Mexico, helped me transport, set up, and break down my installation, and was there for me in case I started feeling unwell. In the three-month long exhibit, I worked closely with the curator, who monitored the installation with me, sent me photo updates on the plants, and always ensured that I had on-site parking access and help with installing and uninstalling. For the exhibit in London, I was connected with local professors and PhD students who hosted me, helped me acquire and transport plants, and supported the installation setup and breakdown. As Bennett et al. suggest: "Access is not only a solution to a disability-related barrier; it is a way of being together and helping one another" [6]. Perhaps these acts of support seem self-evident, but relying on others was the best way I found access in these conference and exhibition spaces.

5.2 Buggy Biodata

My initial interest in using biosensors as a way to measure more-than-human relationships was to challenge the way that biodata is typically used as absolute and "objective" measures of an individual's body in medical practice. In my years of living with chronic illness, my biodata was often seen as a valid reason for my illness to be dismissed because, despite many discomforts over the years, my lab results would usually come back "normal." This led many practitioners to say things like "You're fine! You're young." "There's nothing wrong with you!" "It's just stress." or "It's in your head."

In the following accounts, I think with disability narratives that reveal limitations of sensing technologies in medical settings, feminist literature that foregrounds data as situated, and writings that surface assumptions through errors. Specifically, I share two stories of glitchy biodata readings that occurred during *Sensing Bodies* exhibits that made evident how I inadvertently encoded my own assumptions into the biodata interactions in the installation.

5.2.1 We Are Differently Grounded. I first noticed that the interaction in the *Feeling with Plants* display was not working when I was demonstrating it to one of my friends, S. Normally, when a person touches the plant with an EMG sensor attached to it, the electrical signals would spike, triggering the lights to change colors and increase in brightness. But when S touched the plant, the lights did not brighten. I thought perhaps a connection came loose, so I tried touching the plant. To my surprise, the lights brightened! S tried again, and, again, the lights stayed dim.

The EMG sensor measures electrical activity, normally, of a muscle in a human body. But on a plant, it picks up electrical signals within the plant body. When a person touches a plant connected to an EMG sensor, they are creating a path for electrical conduction. This results in a change in the electrical potential that the sensor picks up as a spike. With this, I configured the lights' brightness to alternate between a binary high and low setting. By default, they are set to low, but they switch to high when a spike is detected, indicating a person's touch. To do this, I set a threshold: when the signal exceeds the threshold, it is considered a spike.

After the glitch incident with S, I observed the same problem happen a few more times with other visitors. They would touch the plant, but the lights would not brighten, even though *I* could trigger the programmed interaction. One day, I went to check on the installation to find that I also could not brighten the lights with my touch.

Eventually, I realized that I had calibrated the triggering threshold to my own body's interaction with the plant at a specific configuration, and that's why some people, and even myself, at times, were not able to trigger the interaction while others could: Our touches were spiking the signal at different degrees, some would meet the threshold while others would not. While many environmental factors, as well as the plant's condition, could be affecting the signal readings, there are also different elements that go into how "conductive" a human body might be. These include the moisture level of our hands or even the type of shoes we are wearing, since certain materials are better insulators from the ground. In fact, we are all differently grounded.

The idea that biodata is situated is not new. Critical and feminist HCI scholars have used biodata in creative projects to show that our bodies are not bounded or absolute, but shift with the environment around us [44, 51]. Related critiques of biosensing technologies, such as how they standardize bodily categories and construct narratives of normalcy and deviance, are also widely circulated in feminist and disability literature (e.g. [19, 58]). I had read all about this, but I did not connect these theoretical ideas with my own practice, that is, until the glitchy biodata reading revealed to me my own assumptions. This brings to mind critical writings on how glitches or errors can reveal structural bias or normative assumptions. For example, Legacy Russell describes the Glitch as "a correction to the machine, and therefore a positive departure" [78]; Ruha Benjamin suggests that glitches in technologies are not spurious, rather, they are signals of how systems work [5].

Of course there are numerous other ways I could have programmed the sensor to resolve the glitch (I will admit that I am a pretty novice coder). But these beginner mistakes also surfaced the situatedness of how sensors measure our bodies. Beyond my own narrative, many others with chronic and environmental illnesses have also described similar experiences of being dismissed or misdiagnosed *because of* inconclusive biodata [12, 36]. If something as minor as the shoes we are wearing affects our biodata readings, what else might be missed, or taken as a given, in other forms of sensing practices?

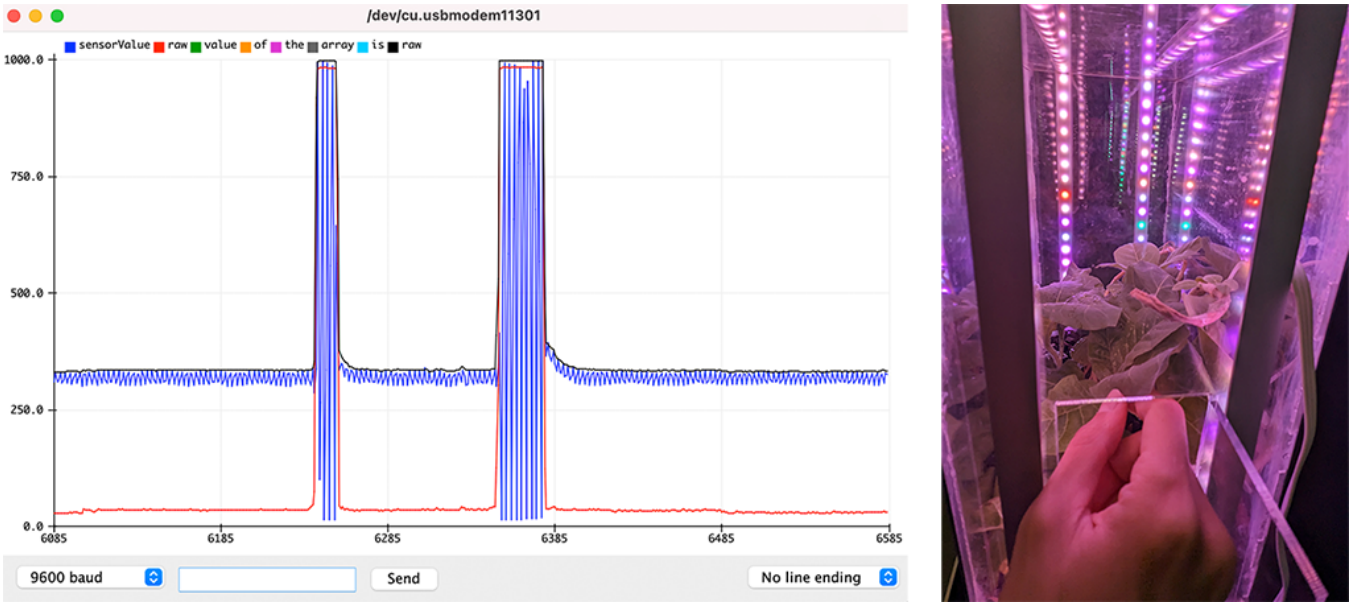

Figure 3: Left: EMG reading showing spikes when a person touches a plant. Right: In *Feeling with Plants*, touching the tobacco leaves is supposed to trigger LED lights to brighten and change color.

5.2.2 All EMG Data Are Local. Another instance of glitchy EMG sensor readings took place during my exhibit in England. When I was setting up the exhibit, I noticed that the signals were extremely high and unstable. EMG sensors can capture a lot of noise, but this was abnormal. In this interaction, there are many things that could go wrong. For example, each plant has a different electrical baseline and requires calibration. How the sensor is attached to the plant can also result in different readings. In this case, that was not the problem, as the celosia plant allowed for relatively clean readings because the smooth and large surface of its leaves is very compatible with the sensor attachment. Other faulty connections in the circuit could also lead to unstable readings, but this did not seem to be the case.

After some troubleshooting, I found that the glitch was coming from the power source. Specifically, England operates on a 230V supply voltage, as opposed to the 110V I was used to in the U.S. I had accounted for this and had my system connected to a voltage converter that steps down 230V to 110V. However, the voltage was not being stably processed by the converter. Eventually, I was able to resolve the problem. However, this blip did highlight how the local infrastructure is entangled with the configuration of technologies and their data.

The incident evokes Loukissas' idea that "all data are local", suggesting that data are inherently connected to place, shaped by the specific contexts in which they are collected, stored, and interpreted [67]. In this case, we saw how sensor data readings not only vary with the plants they are connected to, but can literally be affected by local technological systems. This brings forth reflections on how other place-specific practices and infrastructures might also be entwined with the technologies we use to measure and classify bodies.

5.3 Resistance to Purification and Control

My chronic illness first came to be in an unfortunate multispecies encounter back in 2014, when a deer tick infected with Lyme bacteria, among other viruses and parasites, bit me, a human, accidental hosts of ticks. In the months following, I started to experience headaches, neuropathy, brain fog, heart palpitations, and extreme fatigue. I went on antibiotics, improved, then regressed again. For the years that followed, I would be on and off multiple different types of antibiotics, antifungals, and antiparasitics. These, of course, obliterated my gut biome and led to many other complications that persist to this day.

In the following accounts, I draw from critiques against purity to reflect on the multi-species entanglements that took place in the displays of *Sensing Bodies* and how they reveal ambivalent, plural, and situated more-than-human relationships that reflect my chronic illness experiences. I describe how the installation, with its soil, plants, and their living ecosystems, stood in contrast to sterile exhibition spaces. I recount how I first attempted to "purify" the project by controlling different aspects of it, including how the plants grew. Finally, I share how embracing the messiness and foregoing control facilitated richer interactions and more authentic engagements with the project.

5.3.1 No Soil Allowed. In *Sensing Bodies'* exhibit in Mexico, I was asked to set up outside of the exhibition hall because there was soil in my project, even though most other demos and participants were inside. At the time, I felt a little excluded - most people would be lingering and conversing inside, and, on top of that, the bright natural light outside would detract from the visual effects of the LED lights and two-way mirrors. Unfortunately, the institution had a policy of "no soil in buildings."

After I set up outside, I struggled to get the lighting and mirroring effects to work the way I intended. However, to my surprise,

Figure 4: Left: At the exhibit in Mexico, one can see a view of the natural landscape from behind the exhibit. Right: Standing in front of the exhibit, one can see the reflection of the surrounding landscape merge with the plants within.

I noticed something more beautiful and interesting: I saw the surrounding landscape in the reflection of the mirrors. As one walked toward the exhibit and the brightness of the lights began to shift, the reflection of the trees, shrubs, and their local ecology, along with the interacting participant, merged into the plants bound within the box. Standing before the box, you see hints of the landscape behind you while looking in at the illuminated plant, which was selected to represent the complex histories of this very land. The contrast of the two made the concept of the project all the more salient. Throughout the day, the experience of the interaction shifted as day became dusk. In the evening, the illumination of the plants in an otherwise darkened landscape was even more striking.

This incident reveals how the idea of purity permeates the different ways we try to control our environments. It was reflected in the rules about what is and is not allowed inside of exhibition spaces, but also in how I tried to control the environment in and around my installation. Ultimately, allowing the project to reflect its environment opened up new possibilities and experiences.

5.3.2 Dirt, Bugs, Mold, and More. In the three-month-long exhibit in Georgia, *Sensing Bodies* was displayed in indoor spaces that were very clean and formal. Its curation was professional and polished. Consequently, I also felt the need to keep these environments as "clean" as possible. I would sweep up all the dirt that came out of the box, remove dried out leaves, and make sure the plants looked well-kempt. However, the box was, ultimately, a living ecosystem, and the living plants and soil would invite other things to grow.

One day, after a long weekend, I went to check on the exhibits to find an explosion of more-than-human growth:

> "There were so many gnats flying around in the rice box, and even a mosquito in there! There was also mold growing on organic debris and little soil mites crawling all over…"

I scrambled to "clean up" this mess that I made, and from then on, I would periodically try to get these unwanted pests out of the boxes. However, the specific combination of technologies and plants created conditions that were particularly rife for unwanted growth. This was especially the case for molds. I was not happy about this, as chronic exposure to certain molds can trigger symptoms in my body. In a journal entry, I reflected on the mold that started growing in the soil and on the dead leaves in all of the boxes:

> "I'm basically breeding mold through this project. The boxes are perfect conditions for mold - no air flow, high humidity (trapped in the closed boxes), high temperatures (heat from the lights), with organic stuff to feed on (dead leaves)."

As I observed the molds break down the leafy debris, I reflected on how, despite their noxious spores, these fungi serve a radically important role in metabolizing our increasingly toxic environments by literally "breaking down" matter and recycling waste.

Reflecting on these multi-species entanglements that took place in the boxes, I thought about how they not only mirrored my own ambivalent relationships with more-than-humans, but also how they, in a way, narrated the difficult histories of slavery on plantations that we attempted to tease out through this exhibit (presented in more detail in our previous publication [54]): the labor of trudging through flooded rice fields, exposure to vector-borne diseases, and both intimate and dangerous physical contact with the land, its plants, and other living things. Plantation slavery exemplified both violent and messy bodily entanglements with more-than-human systems, and this very history itself has too often been "purified."

Figure 5: Left: Looking into the box to see wilting indigo plants that have contorted from confined growth. Middle: A new green sprout emerges and is entangled with the wilted skeleton of the dried out indigo plant. Right: Mold growth breaks down dead indigo leaves while a green stem sprouts through the debris.

5.3.3 The Aesthetic of A Dying Plant. In addition to trying to control the more-than-human growth in the boxes, I also tried to keep the plants healthy and thriving so they would look as "beautiful" as possible over the course of three months, especially toward the beginning of the exhibit. However, I recognized this would be a difficult task, and the uncertainty made me uneasy. I felt anxious whenever I saw any hint of droopiness in the plants, nervous that they would die and the exhibition would be cut short.

In particular, the indigo plants were fragile and required a lot of care to keep healthy. Over time, as I redirected my focus from caring for the plants to prioritizing my own health, I found myself unable to devote the same level of attention to them as I initially had. With about three weeks left in the exhibit, the indigo plant began to wilt and die. I tried to revive it in a last ditch effort, but the plant resisted. In a journal entry, I described finding the plant in a dismal state, looking "totally dried out and wilted, some leaves yellow and spotted…"

While I struggled at first to figure out what I should do to fix this "failed" exhibit, I quickly realized that the plants' breakdown was another integral part of the narratives they were meant to represent. As I looked at their dreary form, I reflected on how these plants resisted my attempt to control their growth, took their own course, and how their constant and inevitable change and eventual death embodied a very important message of this project - a project about colonial control of land and bodies through acts of purification. In another entry, I remarked:

> "It was eerie and impactful seeing the dying skeleton of the indigo plant, with its warped branches grown into the shape of the box, lit up behind the two way mirror, in the backdrop of my reflection."

I resigned myself to leaving the dead plant in the exhibit as such, and in interactions with visitors, I would describe the symbolism of the colonial history and violence against both human and non-human bodies.

But in another surprising turn of events, two weeks later, I found a new sprout growing amongst the dead indigo branches, rising from the dried out soil that I had stopped watering because I thought the plant was dead. Another week later, one more sprout emerged. Describing this new growth in my journal, I wrote: "This plant never ceases to surprise me… Now there are two green sprouts entwined with the old wilted skeleton, which is literally decaying, covered in fungal spores."

Through the messy ecologies within the plexiglass box, the plants prevailed with their own agency and resilience. To me, the display became a living representation of what Anna Tsing describes as "coexistence within environmental disturbance" in the landscape [93, p.4] or what Sophie Strand describes as "contaminated survival and flourishing biodiversity" in a human body [87]. In a way, taking a step back from caring for the plants allowed them to take on their own narrative.

6 DISCUSSION

> *"To crip sustainability means valuing disability as a source of insight about how the border between the natural and the unnatural is maintained and for whose benefit. It means understanding a sustainable world as a world that has disability in it, a perspective that recognizes the instabilities, vulnerabilities, and dynamism that are part of naturecultures."* - Stacy Alaimo [3, p.viii]

We have offered reflections on more-than-human interaction from the perspective of chronic illness through an autoethnographic analysis of our project, *Sensing Bodies*. Our findings bridge more-than-human design with insights from disability scholarship through different encounters with breakdowns, illuminating messy ecologies that push against polished, controlled narratives of technological projects. These reflections show how plants, technologies, and a chronically ill body became entangled with each other conceptually and materially, surfacing new sites for more-than-human relationalities. In this section, we unpack what disability perspectives on more-than-human interactions can contribute to design in HCI.

6.1 Cripping More-than-Human Design

We highlight how disability perspectives can enrich more-than-human design by expanding while adding nuance to understandings of more-than-human and environmental relations. In *Crip, Kin, Manifesting*, Kafer asks, "How might those who have experienced medicalized technologies as forms of neglect, intervention, and surveillance begin to cultivate alternative relations to technology?" [60] We offer an example of this through the design of *Sensing Bodies*, rooted in part in uncomfortable encounters with medical practices and technologies from A1's chronic illness experiences. These lived experiences contributed to new configurations of biosensors as well as alternative readings of biodata that resist their individual and "objective" interpretations to foreground their situatedness and more-than-human constitution, as seen in our findings. We add to existing more-than-human HCI projects that highlight biodata as collaborative and sensing practices beyond human orientations [44, 65, 77, 92] while bridging to feminist and postcolonial projects that engage with data and sensing through alternative ways of feeling and knowing [22, 27, 51, 58, 75].

We also note that living with chronic illness fosters unique relationships with more-than-humans and the environment, for example, through an embodied acuity to soil molds or unique awareness of the messy multi-species entanglements within one's own body. Designing from or with this position allows for an understanding of more-than-human relationships that collapses bodily boundaries and recognizes their tensions and multilplicity. It invites ambivalent and plural more-than-human relationalities that shift with contexts and situations. Through disability scholarship, we also found alternative, humanist interpretations of environmental problems that highlight diverse experiences in understanding and addressing ecological crises.

We therefore call for foregrounding disability perspectives in more-than-human design to cultivate new understandings of the plural relationships in more-than-human worlds and alternative insights on environmental problems. We invite HCI and DIS practitioners to engage with these perspectives by collaborating with disabled scholars and designers, incorporating ideas from disability writings into their practice, or reflecting on their own experiences with illness or disability, with particular attention to how these experiences might open new ways of being, feeling, and relating to the environment and more-than-human worlds.

6.2 Inviting Messy Processes into Exhibition Spaces

We highlight how disability perspectives on more-than-human design invited new ways of relating to exhibition spaces and practices. We build on other disability scholars who have re-imagined access [6, 23, 32, 58, 79] to open further discussions on how we might "crip" polished exhibition spaces and their surrounding practices. In our findings, we discussed different experiences A1 faced in navigating installation sites, including both challenging and supportive experiences. For example, in one instance, our project was excluded from being indoors because it had soil; throughout, we felt compelled to "clean up" our installation to "fit in" to their polished surroundings; we noted the importance of having places to rest in exhibition spaces; we also shared what interdependence might look like in these spaces, and how it elevates access in unpredictable situations. These events point to different ways that exhibition practices might accommodate dynamic life and bodies. Exhibitions and showcases often celebrate work that is static, final, and complete, or working toward completion. In a similar way, these events often demand physical stability and stamina of their participants [20]. In contrast, our findings highlighted the "unfinished-ness" and volatility of both technologies and living bodies that require ongoing care and maintenance to sustain a sense of "stasis."

As such, we call for re-imagining exhibition spaces to embrace messy processes of human and more-than-human bodies. We further highlight this space as an opportunity for future design research. We suggest that "cripping" exhibition spaces and practices could start by embracing messy processes and the dynamic conditions of bodies, technologies, and more-than-human systems. This could be inviting living more-than-human ecosystems into exhibition spaces to counter the appearance of purity. It could be highlighting the breakdowns and acts of repair that keep artifacts working, countering the narrative of control. It could also be embracing access itself as a messy process, recognizing that disabilities and illnesses are fluid and dynamic, and often cannot be accommodated through rigid or pre-arranged protocols. Instead, we might rethink how we can integrate social and built infrastructure in these spaces to support unpredictable bodily breakdowns, for example, by offering comfortable resting spaces or places to lie down, or by foregrounding social support as a core part of their practice.

6.3 Adaptation as A Design Strategy

Finally, we share adaptation as a strategy for dealing with uncertainty in design practice. In our findings, we described how "failures" in our installation, including the breakdown of electronics, living materials, as well as a chronically ill body, necessitated real-time adjustments, on-site troubleshooting, and creative responses in each situation. Instead of controlling outcomes, we highlight how these adaptations opened design possibilities and new meanings.

We connect our findings to HCI scholarship that have engaged with failure as a part of reflexive design practice that contributes to knowledge production [29, 43, 90]. We highlight Soden et al.'s call to shift HCI from practices of "solving" uncertainty to embracing it as a generative source for design [83]. We further build on Gaver et al.'s work that introduces emergence as an important aspect of

practice-based design research, highlighting how "methods, tactics, goals and even topics can unfold and change as researchers adapt and learn in the course of their projects" [30, p1].

Throughout the design and exhibitions of *Sensing Bodies*, we made constant adaptations to respond to unpredictable breakdowns or unforeseen situations. Most prominently, working with living plants meant that there were inherent uncertainties: their growth was difficult to control, their survival was not a given, their environment was also in a state of flux. As we saw in the three-month-long exhibit, some plants flourished, some perished, and a few came back to life. Other creatures moved in and grew with, around, and on the plants. We adapted to how they changed - shifting their symbolic connections to historical narratives and our own interpretations of their meanings. In addition, we also experimented with how the sensors meet the plants. For example, we had to re-adjust the EMG sensor in different ways to figure out how to maintain the interaction while keeping the plants alive. In international exhibits, we could not precisely measure the plants' "fit" with the installation or connection with electronics beforehand. For example, in Mexico, we did not decide on our theme or select plants for the display until A1 arrived on site and interacted with the plants herself. In England, we faced last-minute technical challenges that required debugging on exhibition floors. Importantly, alongside adaptations of the installation, A1 also dealt with many uncertainties of chronic illness and had to work through different situations to adapt to her bodily needs. She enacted coping strategies, for instance, by finding places to lie down, moments to rest, and ultimately, by relying on others who helped her through these experiences. Uncertainties in and of these exhibits, and the adaptations in response, allowed the project to grow in real-time, taking form not only through intentional design decisions, but unfolding through, during, and in between each exhibit.

Here, we bring back the connection between environment and disability. In discussing accessible futures, Ashley Shew suggests that the future of the planet is itself disabled, through environmental disasters, pollution, and climate change: We're going to see more and newer forms of disability in the future. While we cannot design for what is unpredictable, we can learn from "disabled experts" to live with uncertainty. Shew writes: "When we ask for the ability to live with uncertainty, we are asking to learn 'the fine art' of being disabled" [80, p.131]. As people with disabilities know first-hand, adapting is an essential part of living with uncertainty, getting us through the unplanned breakdowns of unpredictable flares, for instance. Adaptations allow us to live in the "in between," navigating the tensions of what is controllable and uncontrollable, and balancing the present with the future.

Accordingly, we join calls for embracing uncertainty as a source for design. We put forth adaptation as a strategy of responding to failures and uncertainties while embracing them - a way of "becoming with" uncertainty. Incorporating adaptations as a part of design outcomes transforms how we might relate to design processes and designed things. This can take form in different ways: it can mean not over-controlling design narratives to foreclose possibilities, for example, by embracing messy multispecies agency and allowing new meanings to emerge with changing conditions. It can mean foregrounding practices of maintenance and care as part of the "finished" product, recognizing that continuous adjustments are intrinsic to any artifact, especially ones with living things. It can mean finding a way to access, especially through collaboration and mutual support, highlighting social and relational processes in navigating unpredictable situations. In this light, adaptation is not merely a reactive response to unexpected failures, but a proactive approach to design that stays with the trouble [35].

7 CONCLUSION

In this paper, we offer a disability perspective on more-than-human design in HCI. Specifically, our work suggests that, although more-than-human design seeks to pivot away from human-centeredness, starting with disability perspectives can add nuance to understandings of environmental problems and relations and invite new ways of designing for ecological and environmental justice. Through an autoethnographic study grounded in A1's experiences with chronic illness, we reflected on the design, maintenance, and exhibition of our project *Sensing Bodies*. Intersections between disability theory, chronic illness experiences, and more-than-human design emerged through various encounters of breakdowns. These breakdowns were seen in acts of maintenance and care for plants, technologies and a chronically ill body, glitchy biodata readings in human-plant interactions, and messy multi-species ecologies that unfolded around and within the displays. Through this work, we invite others to engage with disability perspectives in more-than-human design, call for new ways of imagining access in exhibition spaces and practices, and bring forth adaptation as a strategy of responding to breakdowns while embracing them. These insights invite us to rethink what it means to care for interdependent, more-than-human worlds.

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