Biographical Prototypes:
Reimagining Recognition and Disability in Design

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ABSTRACT

This paper aims to elevate stories of design by people with disabilities. In particular, we draw from counter-storytelling practices to build a corpus of stories that prioritize disabled people as contributors to professional design practice. Across a series of workshops with disabled activists, designers, and developers, we developed the concept of *biographical prototypes:* under-recognized first-person accounts of design materialized through prototyping practices. We describe how the creation of such prototypes helps position disabled people as central contributors to the design profession. The artifacts engendered an expanded sense of coalition among workshop participants while prompting reflection on tensions between recognition and obligation. We end by reflecting on how the prototypes—and the practices that produced them—complement a growing number of design activities around disability that reveal complexities around structural forms of discrimination and the generative role that personal accounts may play in their revision.

Author Keywords

Disability, workshops, design methods, prototypes.

CSS Concepts

• Human-centered computing~Interaction design processes and methods

INTRODUCTION

"*Our founder created the first OXO peeler for a pair of hands he loved more than his own. When his wife struggled with a traditional metal peeler, he knew there was a better way, and he created it*" [47].

So says OXO's website about Sam Farber, a founder of the popular kitchenware brand. Recently disabled design activist Liz Jackson found the person to whom those hands belong: architect Betsy Farber, who has arthritis. Reflecting on this story during their interview, Farber told Jackson,

"*The general understanding was of the brilliance and kindness of Sam who made these tools for his poor crippled wife so she could function in the kitchen. I will probably go down in history as having arthritis rather than having the conceptual idea of making these comfortable for your hand*" [34].

Over the past decade, design pundits have celebrated the OXO kitchenware story as a paradigmatic case of disability and design *gone right*—illustrating how designing for someone with disabilities involves creating a product that appeals to everyone (and consequently providing financial justification for the investment). But prior to Jackson, no one had thought to publicize an account by the person whose hands had been "designed for." With more research, the OXO case suggests that stories of designing for people with disabilities may well hide the fact that people with disabilities *do* the design—or, more accurately, they do the uncredited work that firms such as OXO professionalize as design.

Stories like Sam Farber's often circulate within the design profession. They tend to cast disabled bodies as nondesigning bodies and, conversely, designing bodies as nondisabled bodies [9]. They can position nondisabled people as the leading creators of technologies and design solutions. Scholars observe how this positioning further defines a systematically disadvantaged population by the opposite characteristics of the dominant population [76]. In practice, this positioning also separates design work from the people with disabilities who make it possible, reinforcing a cultural program of exclusion.

Figure 1: Betsy Farber's OXO biographical prototype could illustrate her work by depicting the handle of a conventional peeler covered in foam or Play-Doh paired with a vignette describing her firsthand experience coming up with the idea to adapt the peeler to be comfortable for her grip.

Figure 2: Participants working together to create biographical prototypes in small groups at the downtown public library.

With this paper, we explore a partial response to these exclusions. In particular, we introduce the concept of *biographical prototypes*: material demonstrations of how individuals with disabilities have made, adapted, and repurposed their environments and objects to work for them. For example, with the OXO story, a biographical prototype could be made to recognize the work of Betsy Farber by covering the handle of a conventional peeler in foam so that it's larger and more comfortable, and then pairing it with her first-hand account of her role in the prototype's inception (see Figure 1 and caption). We take up the language and practices of prototyping, and intentionally entangle them with first-hand stories to amplify historically silenced design contributions. With this intervention, we seek to do more than uncover omissions; we also aim to bring under-recognized stories back into exclusionary professional design processes.

In the sections that follow, we describe the creation and sharing of biographical prototypes across a series of workshops that we organized with disabled activists, designers, and technology developers in the downtown public library of Seattle, Washington. During the workshops, the prototypes became objects to think with, opening discussions about the types of stories that get told and suppressed within design settings. We discuss the potential consequences of elevating particular forms of work as contributions to professional design when the title "designer" feels unmerited or unwanted.

Three central contributions follow from this analysis. First, we explore a form of coalition-building not typically considered in technology design: learning to *be with* another rather than *be like* another [20]. Instead of instructing designers to "step into someone else's shoes" (and tacitly approve stepping back out at will) [48], we aim to take seriously people with disabilities as meaningful contributors to professional design practice. Second, our work highlights the centrality of *stories* (and particularly *counter-stories*) in design and prototyping. We critique prototyping approaches by materializing forms of retelling as a praxis for designers to consider what and who contributes to their practice. Third, we expand conversations on participatory design by exposing the additional burden put on people systematically disadvantaged within the design process when they feel obligated to do or even take credit for design.

BACKGROUND

To contextualize our work, we turn to scholarship within disability activism, participatory design, and critical prototyping—each offering approaches for getting at stories less told in design. Rather than an exhaustive survey, these literatures provide starting points for exploring alternative forms of design knowledge and recognition.

Everyday and Participatory Design

Design and HCI research has considered people's ways of designing through incremental adjustments in their everyday environments. Scholars have considered the creative acts that become meaningful to people involved—such as family members rearranging clutter on their kitchen counter— whether those acts occur within homes, parks, or workplaces [18], [68], [70], [75]. Desjardins and Wakkary [18] and Taylor and Swan [70] show how such acts of adoption and reuse reflect mundane, invisible forms of creativity that are often only noticeable to the people doing the work. Other work has recognized the ways people with disabilities incrementally adjust their environments. Whether by modifying prosthetics [8] or decorating hearing aids [51], projects like these position people with disabilities as "everyday designers," rather than simply users of assistive technologies.

Harnessing these mundane forms of creativity, scholars of participatory design (PD) have developed techniques for partnering with people with disabilities and other relevant stakeholders toward accessible design solutions [25], [40], [41], [49], [58],[71]. Common among these approaches is a focus on futuring differently in order to account for diverse perspectives. Kristina Lindström and Åsa Stahl [38] recently developed speculative workshops that invite people living near toxic waste to develop their own gardening practices for environmental remediation. These and other projects have called for design researchers to shift their gaze from individual problem-solving to addressing wider public concerns and activist programs [5], [9], [10], [11], [23], [37], [50].

Objects as Thinking Companions

To inform methods of recognition within design research we turn to the role physical materials and objects have

played in constructing stories about everyday life (see [32]). Attending to the significance of objects in people's lives, scholars have pointed to the importance of what theoretical archeologist Rosemary Joyce calls *material traces* [35] (see also [56]), physical instantiations of time and activity that elucidate an object's social life. Such readings extend anthropological understandings of personhood to the objects we interact with [3], positioning objects as personally and epistemically significant and agential [6]. Objects, in this sense, have social lives and, through their circulation, mobilize the people they encounter. Anthropologist Janet Hoskins [29] and science and technology studies scholar Sherry Turkle [73] separately explore how personally and culturally meaningful objects work as companions to think, feel, and develop with. For example, Hoskins introduced the concept of biographical objects to discern certain items that her Indonesian interlocutors prioritized as important in their storytelling [29]. For Turkle, intimacies with meaningful objects characterize 'evocative' relationships which might bring out cultural specificities or important events. By making theory-building concrete and material, Turkle explains, "evocative objects bring philosophy down to Earth" [73] p. 8. To these scholars, relationships with and among objects can achieve deep personal as well as analytic significance (see work on personal inventory, for example [45]).

Prototyping as More-than-Futuring

Other work has explored prototypes and prototyping practices as a means of analysis. Indeed, approaches that span prototyping pasts [60], critical making [53], and design fabulations [55]. consider the ideological roots of design's formal prototyping mechanisms. Pushing against a reductive reading of prototyping as a solely technological achievement [74], this work offers analytic footholds for using material production as a mode of scholarly critique. As Tim Sherratt argues, *"There is power embedded in every CSV file, every API is an argument"* [63] (also cited in [24] p. 44). Examples include prototyping as argumentation [27], prototyping as theorizing [52], and, most relevant for our purposes, prototyping as archival analysis [60].

Naming this latter practice "prototyping pasts," Tiffany Chan, Mara Mills, and Jentery Sayers describe their reconstruction of the octophone, an early reading technology for blind people, and their use of this reconstruction to elevate the story of Mary Jamison, an under-recognized blind inventor of the technology [13], [14]. In this and other projects [28], [43], [59], Sayers uses the practice of prototyping pasts to name patterns of minimizing and silencing key informants whose early contributions go under-recognized within dominant histories of technology development. In other work, sociologist Kat Jungnickel and her collaborators use patents to inform prototypes of the pioneering convertible bloomers that Victorian women cyclists created for moving through London, elucidating a pivotal yet under-examined inventive practice [36]. As Chan and colleagues write: "*Like translation more generally, prototyping does*

not seek a straightforward, 1-to-1 equivalency, nor does it seek to replicate past devices or embodied experiences. Instead, it highlights smaller gains or losses over time and across versions. That is, it foregrounds difference and absences: what we cannot retrieve, repeat, or translate in the present" [14].

We take up this interest in foregrounding difference and absence by figuring design as a generative mode of critical inquiry. Arguably the recent attention to labor within media studies scholarship works as a form of participatory storytelling and materialized biography, tethering media studies to participatory design [57]. As for Chan, Jungnickel, Rosner and others, our materials and prototypes are not replacements, beginnings, or endings, but instead openings for elevating forgotten, untold, and uncredited design contributions. We weave this attention to absences into a focus on everyday and participatory design in contemporary life. This renewed attention to gaps in storytelling—a counter-storytelling—underpins our conceptual development of biographical prototypes.

BIOGRAPHICAL PROTOTYPES

Biographical prototypes are material manifestations of people's oral or written personal stories of 'making something work.' They combine the language and practices of prototyping with a person's under-recognized stories of design (called *counter-stories [65]*) to establish such work as meaningful to professional design practice. Notably, as for our inquiry, designers can use the prototypes to foreground people with disabilities as the fashioners of their own stories and associated representations in design contexts. The prototypes take a wide variety of forms, from representations of artifacts that people invent, to illustrations of rooms that people modify, to mock-ups of digital applications that people repurpose or put to a new use. Their form and contents range from provisional sketches to full replicas that reflect pasts and imagine futures (see Figures 2 and 4).

To develop biographical prototypes, we borrow particularly from counter-storying practices within critical race theory [65]. For our purposes, counter-storytelling resists dominant narratives of people with disabilities (such as Oxo's version of their vegetable peeler's invention [47])that depict disabled people in auxiliary roles and present disability as a deficit. Counter-stories like Betsy's version [34] have become a powerful tool for disability activism. Using counter-stories to exhibit disabled people as dynamic protagonists and as meaningful contributors in sectors from which they have traditionally been left out, disability activists seek to nurture hopeful conditions of possibility for people with disabilities (e.g., see [12], [16], [22], [42], [54], [77]).

With biographical prototypes, we take up this form of counter-storytelling as a tool to bring close and uplift stories by and about people with disabilities to complement other storytelling taken up in HCI [21], [33],[39] , [62], [64], [69]. Closely aligned with PD approaches, particularly those of Ann Light [37], Åsa Ståhl, and Kristina Lindström [38], and

Figure 3: Selection of prototyping materials and narrators' biographical prototypes brought to the workshop. Nikki's back scratcher on the far left; Dianna's jeggings and sequins and wax-covered pen in the middle; and Nikki's embroidery holder featured on the far right.

taking up Susanne Bødker and Morten Kyng's [11] call for PD to challenge wider structural practices, we use these collective material acts of representation to invite designers to consider what it means to *be with* [20] perspectives that challenge and open up dominant accounts about what counts as design.

In short, this kind of prototyping offers a potential means of addressing longstanding challenges around conceptions of design and disability. Through collective prototyping based on personal experiences, we strive to step back from misconceptions that cast people with disabilities as auxiliary in design. As such, we describe our process of developing biographical prototypes in practice. The process enables us to explore what it might mean to *be with* people with disabilities while occupying our researcher and designer positions complicit in upholding the marginalization we aim to dismantle.

Our inquiry involved two main phases: (1) formative work including collecting stories by people with disabilities and developing a first round of biographical prototypes based on those stories, and (2) workshops during which people with disabilities collaboratively made biographical prototypes to illuminate their own experiences inventing, modifying, and repurposing in their everyday lives.

FORMATIVE WORK
Our project began with the goal of collecting stories of design within the everyday lives of people with disabilities told by the people experiencing them. To inform this process, Bennett conducted one-on-one interviews with four people with distinct disabilities (here, termed "narrators" in line with oral histories methods [46]) during four months of 2018. From the interviews we produced audio recordings and full transcripts. We complemented this material with a literature review on designers with disabilities.

To learn how disability fit into their life experiences holistically, interview questions inquired not into disability per se but into the objects and environments that narrators had made, adapted, or repurposed to work for them or make activities accessible. Bennett also asked for stories of unsuccessful attempts and ongoing challenges. She conducted

the interviews in narrators' own spaces where they often had access to the objects they spoke about at which point they could also demonstrate their use.

We chose to not use the word design during the interviews with the hope that the narrators would tell any story related to material alteration or development (and not feel limited by the elite cultural status of the design professional, as demonstrated by prior work [72]). Complementing the interviews, we curated a selection of stories derived from our review of related literature and popular media articles. We chose two stories from our review (such as Betsy Farber's) for their depictions of people's recent pasts from multiple perspectives, allowing us to contextualize for participants our motivation for taking up counter-storytelling practices.

To create examples for our workshops, the research team, some of whom have disabilities, reviewed the collection of stories and developed an initial set of 14 biographical prototypes made of store-bought and found artifacts (see Figure 3 and caption). Consider the six examples described below.

Nikki's Tupperware grabber comprises a backscratcher with tines. Nikki described using a backscratcher to hook onto the lipped lids of Tupperware they keep on high shelves. The tines helped them pull the items down. With relatively short arms, Nikki wanted to extend their reach. The backscratcher enabled skillful extension.

Nikki's embroidery holder comprises several embroidery samples including: a large wooden hoop, a broken wooden hoop, a large plastic hoop sewn to a cushion, and a small plastic hoop. Together these elements illustrate the story of effortful trial and error involved in Nikki's work to learn embroidery with one hand. Describing their embroidery course, Nikki told us how their instructor held a large, wooden hoop in midair with one hand and stitched with the other. Following the instructor, Nikki first tried sitting on a similar wooden hoop to free their hand for stitching but, in the process, broke the wooden hoop. Nikki then tried a plastic hoop and found it more durable but not perfect: they sometimes embroidered into their wheelchair seat cushion while sitting on the hoop. They finally switched out the large plastic hoop for a much smaller one in order to neatly

Figure 4: We held three workshops in the Seattle downtown public library where disabled activists, designers, and developers collaboratively developed a wide variety of biographical prototypes.

balance the hoop between their torso and the wheelchair's arm.

Diana's bead gatherer comprises a spatula wrapped in double sided tape with a box of beads. Diana, who has motor disabilities and uses a wheelchair, enjoys crafting with beads. Once, after dropping beads, she found objects in her vicinity to collect them. She wrapped a spatula in double sided sticky tape to extend her reach and catch the beads as she swept.

Diana's rhinestone transporter comprises a wax-covered ballpoint pen with a plate of rhinestones. When Diana added smaller beads such as rhinestones to her projects, she covered the ink end of a pen with wax. With this tool, Diana could lift the intricate items she wanted and place them precisely onto her work.

Diana's altered jeggings comprises a pair of stretchy jeans with hair ties sewn into either side of the waistband. With motor disabilities impacting her reach and grasp, Diana found it hard to pull up her pants. After a long day of not having access to a restroom, she sought out flexible pants in maternity sections. The maternity pants worked for a while, but Diana grew tired of unsolicited questions about pregnancy. As jeggings were coincidentally gaining popularity, she tried on a pair and learned that she needed a bit more assistance than the stretchy material gave. In response, she altered jeggings with hair ties that she sewed into the left and right sides of the waist band for easier tugging. The adaptation represented moments of learning what clothing did not work for her over time.

Julia's calendar comprises both paper and digital schedules. Allocating time allowed Julia to prioritize her medical appointments and work first before choosing which social activities to attend. The structured documentation came in handy when she had difficulty remembering what she should do next.

Toward Opportunities for Listening

Contrasting with prototypes meant to solicit feedback, we intended the above artifacts to materialize a pathway toward listening to stories by people with disabilities. To accompany and contextualize the artifacts, we created small cards displaying excerpts from our interview transcripts (in both print-form and braille) in preparation for workshop participants with a range of disabilities to read and engage with the prototypes. We learned to see the provisional illustrations not as biographies in themselves, but as biographical moments. Generally ephemeral and short-lived, the experiences that narrators shared could never encompass a biography in full. Instead, they materialized particular, often deeply personal memories. In this form, they transcended the stories they told to transform clutter into situated objects [56]. We built on this concern while preparing for our workshops: holding onto a sense of provisionality by treating connections between stories as incomplete as well as generative [60].

ANALYSIS: PROTOTYPING WORKSHOPS

We developed and facilitated three workshops with a total of 27 people with disabilities for the sharing and creation of biographical prototypes. We held the workshops at the downtown public library, as it is a public place centrally located near public transportation and standard accessibility features. The workshops were grounded in the facilitators' commitments to center access which shifts access from an achievement to a process [1], [6]. This commitment began with preparations for reporting access needs before the workshops. Bennett communicated with each participant about their access needs, offering a summary of the workshop program which helped to bring out and clarify additional adjustments. Access commitments were overviewed at each workshop's outset which helped establish access as a central and collective commitment for which all attendees had the responsibility to cultivate. These access considerations included: remaining scent free, having one person speaking at a time, offering ample time for participants to express themselves, directly conversing with people and not interpreters, using people's pronouns, announcing one's name before speaking, and returning items to their place to maintain organization.

All workshops comprised four main parts: (1) introductions and set up, (2) encountering stories and autobiographical prototypes, (3) co-creating biographical prototypes, and (4) a concluding discussion.

Methods

Our methods draw from PD workshops as well as feminist approaches to situated inquiry (detailed above) [17], [67]. Feminist traditions emphasized the contingent and embodied nature of knowledge productions, and traditions of participatory design foregrounded alliances across expertise. Informed by a feminist commitment to reflexivity, we con-

sider ourselves as participants in, rather than merely observers of, the design asymmetries to which we sought to draw attention. Our team included three researchers and six volunteers working in engineering departments at the University of Washington.

We recruited participants by posting printed flyers in public and disability-centered spaces at the University of Washington. We also circulated email notices to local list serves run by people with disabilities. We selected workshop participants to reflect a diversity of disabilities, gender identities, and people from groups otherwise under-represented within professional design practice.

Drawing on inductive techniques [15], [17], we analyzed our data thematically based on how they shed light on the role storytelling plays within prototyping, design, and disability. Three questions organized our analysis: (1) How do participants engage with biographical prototypes? (2) What types of biographical prototypes emerge from our participants' personal stories? (3) How do biographical prototypes lend themselves to discussions of design, disability, and storytelling within and beyond the workshop? To develop to these questions, we iteratively wrote and refined reflective memos derived from our interview transcripts, field notes, biographical prototypes, and audio and visual recordings. We then identified important themes that occurred across the three workshops through subsequent rounds of collective analysis by the research team. Our report reflects themes prominent in our synthetic analysis. Narrators and participants either chose a pseudonym or permitted the researchers to choose a name popular among people with the same gender identity and ethnicity.

Lessons: At the Workshops
People took their time to arrive, grab snacks, and find their place at a long conference table stationed in the middle of the room. Some attended carefully to where they sat in relation to others. A few participants already knew one another through their disability communities. Those participants used the set-up period to rekindle connections and introduce themselves to new neighbors.

Introductions and Set Up
After establishing the aforementioned access commitments, we invited attendees to share their names, pronouns, and reasons for attending. At this point, facilitators announced themselves available to assist. We then asked participants to reflect on whether they felt they were outgoing or not and to step back or step up accordingly. (We repeated these communication considerations before each group discussion, reminding participants that we sought everyone's stories and reflections.) Facilitators noted when people shared and called on those who remained quiet, offering them time to share if interested.

Encountering Stories and Biographical Prototypes
Following participant introductions, we told a few directed stories including one about OXO founder Betsy Farber (see introduction). We then drew participants' attention to the narrators' biographical prototypes displayed on the conference table and felt the excitement in the room intensify. The prototypes' proximity seemed to encourage participants to reach forward and explore the objects in front of them. To contextualize the stories, we guided participants through a few biographical prototypes before asking them to engage with the artifacts freely. However, we discovered this free engagement required additional scaffolding by circulating facilitators. We began to intentionally pass objects around to ensure that each participant learned about each biographical prototype. With this passing along, we took care to give each examiner time to read the accompanying story. After participants had a chance to explore several prototypes passed around the table, we asked them to share with the whole group any biographical prototypes that resonated with them. These reflections often sparked personal and sometimes humorous anecdotes. We learned that this slower, reflexive process became an important part of centering access.

For example, a biographical prototype prompted Tali—who uses a cane to assist with balance and who has difficulty reaching shelves—to share their recent experience grocery shopping and finding no employee available to assist them. They told the group: "I'll have my cane with me, and I'll be using one of those motor carts. If there is something on a high shelf, I'll use the hook [of cane] and knock it into my cart. Sometimes the employees get a laugh out of it." Tali's story emerged in response to Nikki's Tupperware grabber prototype that we created from their interview. While describing Nikki's backscratcher, Tali found humor in their own everyday activity.

During a similar moment in the first workshop, Ari mentioned the eye strain they experience while engaging in their crafting hobbies. Ari shared this experience while pointing to Diana's bead gatherer and rhinestone transporter, two biographical prototypes we created based on Diana's interview. Learning from Diana's prototypes, Ari speculated that similar workarounds might help reduce their own fatigue.

Much like Tali and Ari, several workshop participants used the biographical prototypes to not only share personal stories but also learn new ways that people with disabilities adapt their worlds to get by. Looking across the table, participants variously called the prototypes "remarkable" (Ari), "impressive" (Shay), "simple solutions" (Carrie), "ingenious" (Ray). "I'm blown away," said one participant (Tai). Carrie captured this sentiment when she noted, "*One of the things I keep thinking about is [that] the way I was taught to talk about disability was about what accommodations do you need. But that didn't come up here [...]. It feels like a set of skills that's a bonus and not something to apologize*

for." As conversation pieces, the prototypes and their examiners drew appreciation and praise from participants, and also began to help frame disability differently.

Co-Creating Biographical Prototypes

We divided participants in groups of two or three people and asked them to share something they made work for themselves as well as to collaboratively prototype that story (the object made, the practice of making it, or associated emotions). We selectively intervened to encourage participants to meet new people or to pair hesitant participants with participants who seemed to provide openings for others.

In their small groups, participants dove into the variety of arts and craft supplies available on the table in front of them. Particularly useful items included the braille and print writing utensils and a variety of molding tools such as Play-Doh, Wikki Stix (string covered in wax for easy sticking), pipe cleaners, tactile foam stickers, felt fabric, and Sensational Blackboards that when drawn upon raise lines (see Figure 3).

A number of prototypes showed how people put objects to use for purposes that were not explicitly intended by the manufacturer. Katherine—who has memory loss—sketched a dinner delivery subscription box out of Play-Doh. Presenting the prototype, Katherine described the chronological instructions and prepackaged ingredients made comprehending recipes easier; empty ingredients containers were useful reminders of whether steps were completed. Ahsoka and a few other participants made 2 and 3D drawings of calendars and notetaking apps that they repurposed as essential tools for staying focused and managing stress. Ahsoka's choice of app was particularly informed by her sensitivity to alarm noises; she preferred silent, color coded notifications. These participants repurposed existing objects to work with their access needs elevating these resources from convenient to essential tools for 'making things work.'

Other prototypes depicted objects participants invented. These stories often foregrounded provenance: the need or interest that instigated their interventions such as a scarcity of accessible objects or resources to obtain them. Alex—who uses a feeding tube and is Deaf—worked with their partner to create a prototype from a plastic water bottle and pipe cleaners to depict their inventive approach to eating. While waiting on insurance funding to purchase a pump that delivers food to their feeding tube automatically, they received a small syringe from a healthcare provider. Requiring manual filling, the syringe made eating more laborious and time-consuming. In response, Alex created their own interim feeding tube pump by incorporating the syringe into a plastic water bottle. They cut the bottom off of the water bottle, punched a hole through the lid, and threaded the syringe through the hole, connecting it to their feeding tube. They then filled the upside-down water bottle with more food than could fit into their syringe so that, as the syringe emptied, food dripped into it. They additionally taped the bottle to a nearby surface making it possible for Alex to eat while multitasking. Using the prototype—and communicating through an American Sign Language interpreter—they told their story of building the actual system.

Another set of prototypes shared how participants redesigned and reconfigured spaces to work for them. For example, Aaron and his group drew a map of his apartment demonstrating his strategic arrangement of furniture to align paths so that he can grasp sturdy objects while walking. This rearrangement of furniture allows Aaron to forego using crutches at home, as they become cumbersome to manage in the small space. A similar story came from Karen who cultivates several species of lavender, each of which requires unique care and harvesting. Being blind, Karen could not discern the different species since they had similar scents and textures. The garden's spiral shape, preferred for its aesthetic, meant she also could not identify plants by counting them. At the workshop she shared these challenges and worked with her group to produce a tactile representation of the garden from pipe cleaners and foam, re-materializing the paths she designed through each row of plants. Karen explained that she alternated materials as she laid down the curving paths (one with brick, then one with stone, then one with brick, etc.) so that she could discern species by associating them with the nearby path's material. Together, these design choices helped her produce a desired affect while keeping care and harvest tasks accessible. For Aaron, Karen, and others, negotiating inaccessible spaces felt inevitable. As such, they reshaped spaces in their homes and gardens to work for them, and their biographical prototypes honored those spaces.

Looking beyond physical material, a final set of prototypes depicted mental and emotional work. For instance, Raphael made a heart and hammer out of Play-Doh to represent the anxiety he felt not expressing his gender identity before transitioning. The hammer represented "tools" like therapy, coming out, and stress management, each of which he felt alleviated negative symptoms of mental health conditions. Grant made paper versions of the multiple schedules he creates and manages. Rather than feature the tools he leverages, Grant illustrated his creative and difficult processes for keeping responsibilities in check—both for himself and his caregivers. He allocates time between his classes to complete tasks requiring a caregiver. He then must examine three caregivers' availability and schedule their work hours. For Raphael, Grant, and others, biographical prototypes of making things work augmented stories of expending mental and emotional energy. Although objects themselves, the prototypes also worked metaphorically.

Concluding Discussions

Upon completion of the prototypes, the small groups reconvened as a larger group. We invited each participant to share their biographical prototype and we posed a series of reflection questions that set up a discussion around who counts as a designer. Questions included: Do you often

have opportunities to share stories of making things work for you in your own life? What types of stories get told more often? What stood out about the workshop? Is the story you told today a design story? Why or why not?

During these discussions, participants tended to vocalize appreciation for the example biographical prototypes and the sharing and honoring of personal stories. But some participants (Andrea, Genevieve, Matt, Ray, Shiori and Viraj) expressed difficulty thinking of a story from their own lives to share. Andrea, Matt, and Viraj preferred to come up with new designs more than revisiting existing experiences. Further reflecting on these responses, we now examine broader themes and limitations emerging across our encounters.

WORKSHOP REFLECTIONS

These concerns for producing stories echoed comments Bennett heard while circulating among participants before and during the prototyping phase of the workshop. For example, when asked to work with partners and share her own story, Genevieve explained, "*I'm looking at them [biographical prototypes] and I'm thinking, 'Oh, look at this!' I feel like these people can do everything right and then there's me.*" Hearing this concern, Bennett engaged with Genevieve one-on-one and learned she had not encountered Nikki's embroidery biographical prototype, which featured setbacks and successes (elaborated above). Together, they reviewed Nikki's biographical prototype and Genevieve began describing the braille and tactile labels she prepares and adheres to home appliances and products. Her frustration subsiding, she soon began writing braille in demonstration to her partners. In this sense, the biographical prototypes didn't foster an easy connection to a personal story for everyone evenly. Next we examine these limitations to help us calibrate the conditions for recognition that biographical prototypes make possible.

Challenging Confined Stories: On Pressure to Tell Happy Stories

One of the most salient themes that emerged during both the prototyping and reflection phases of our workshops concerned the frequency and nature of the stories that their prototypes represented. Participants reflected on typical experiences of storytelling and agreed they were rarely asked to tell stories about getting by with disabilities. The opportunity to tell these plural stories of plural lives broke through the far narrower misconceptions others had about life with disabilities. However, they noted often feeling pressured to tell stories with happy endings. While prototyping, we noticed that the workshops gave participants space to question that pressure and explore alternative types of stories.

Many participants viewed the prototypes as marking a rare and welcome occasion for recognizing the personhood of people with disabilities. As Katherine explained, "*I don't think I've ever—and I was injured 30 years ago—been asked to share around making things work for you with your disabilities.*" Katherine's experience signified general agreement among participants that they seldom shared stories about disability and 'making things work.' Feeling similarly stripped of opportunity, Tali speculated about connections between absent forms of storytelling and wider patterns of discrimination: "*[Who is credited with design] depends on who is given the most agency or seems to have the most. … If you assume that everyone else is doing something for this person you won't think of that person [as] possibly coming up with that [design] for themselves.*" For Katherine, Tali, and others, being asked to share stories about getting by with disabilities was rare. Informed by their personal experiences, they posited that they were not expected to tell such stories because many nondisabled people assumed that people with disabilities receive, not design, assistive technologies.

However, when given the opportunity, participants appreciated sharing parts of their lives and personalities through biographical prototypes. Genevieve's biographical prototype, for instance, exemplified how storytelling could present multiple sides of our participants. It featured a book cover made from felt fabric inside which rested a page with a braille alphabet she created. The object symbolized a literacy technique that she uses to access reading material and identify items around her house. But the biographical prototype also created a means for her to share her ongoing advocacy for braille despite text-to-speech alternatives which in her experience, have led to a misconception that braille may become obsolete. Genevieve went on to share that as a member of a civil rights organization of blind people, she raises awareness about braille to policy makers in order to preserve its instruction in schools. Genevieve's biographical prototype helped to pluralize her life experiences by offering not only one way she 'makes things work,' but also provided her an opening to share how braille has become a passion which she channels through her community service.

During discussions, participants conversed at length about a pressure to share stories with happy endings. Though well received by everyone, many stories took the form of Genevieve's, ending with successful objects and techniques. But Trinh described how these stories might not be representative. She mentioned strategically choosing among stories she could tell about her disabilities: "*When I tell stories about spinal cord injury, I tell [people that] I used to be in a wheelchair and now I use crutches. But then problems [such as chronic illness] I don't talk about. It opens up vulnerability. It isn't an inspiration story.*" By telling an "inspiration story" (in Trinh's case, focusing on transitioning from using a wheelchair to walking rather than on the ongoing challenges of managing a chronic illness), she and others could relieve what she felt to be a paternalistic desire to fix things on the part of nondisabled people, as well as potentially avoid feelings of vulnerability. Other participants with chronic illnesses especially connected with this struggle. Lee—who has motor disabilities and chronic pain—walked through a hypothetical conversation he avoids: "*'So, what have you been up to these days?' [people ask]. I*

hate that question, [so I respond], 'I only had 6 migraines this week instead of 7, so one day I got out of my apartment.'" Despite what most people want to hear, he explained, *"None of my conditions are going to get better. They might get worse."* Finally, Parker corresponded with Bennett after their workshop. While some participants felt comfortable sharing the messier aspects of disability, Parker realized they hadn't included that in their retelling: *"A missing part of my 'story' was the drama - the pain, the loneliness, the despair, the failings that came before my victories. I'm still learning to make and take space to illuminate the 'ugly' parts and not just the wins."* Though rarely asked to tell stories, participants felt pressure to share the "wins" when we invited them to tell their stories. Yet for Trinh, Lee, Parker, and others, these *wins* did not represent their experiences. Their experiences contained much pain and sadness in ways they may never want resolved (or have the ability to resolve). They instead sought to complement this celebration of disabled creativity with invitations from others to be vulnerable.

Disempowerment, Exhaustion, and Disinterest
With biographical prototypes, we began to see not only the workings of recognition within design but also its potential pitfalls. While participants generally appreciated interacting with biographical prototypes, some also voiced skepticism. Telling their own stories of making things work and making space for such tellings could feel insufficient and obligatory.

Some participants found the work they represented exhausting and felt disinterested in calling the work 'design.' Parker, who is autistic and visually impaired, shared that they decided not to do a variety of tasks such as wear makeup since devising an accessible solution felt too arduous. During workshop discussions, they opened up about the fatigue that informed their decision not to wear makeup: *"it's valid to be over it or exhausted. I can have all of the feelings that I have about it. As a disabled person it's [making things work] compounded."* Carrie—who uses a wheelchair--similarly questioned whether people with disabilities should want to be cast as designers, elaborating, *"I don't really want to be the designer, I want someone else to do the designing and I want to benefit from it. I think the Pollyanna part of it is, 'well we're all designers!' But is that the optimum condition for people with disabilities? Should I be making stools [biographical prototype of using a stool as a lower cooking surface] for myself forever? That feels like a job title I don't want."* Parker and Carrie felt disinterested in being credited as designers, and instead preferred professional designers to take on the task of prioritizing accessibility as standard design practice.

A few participants felt biographical prototypes put too much of a stake in individuals' hands. Andrea's biographical prototype relayed her difficulties viewing small screens on video cameras with a vision impairment, a task essential for her job filming and publishing disability rights cam-

paigns. She prototyped a model camera with a new feature. The foldable LCD screen would remain compact for transport but enlarge to increase visibility during use. During the final discussion, Andrea expressed that her urgent access needs would only be known inside the workshop. *"I guess I can start a social media campaign…, but I'm feeling a bit disempowered in that it's not actually changes that I can make [to cameras]."* Andrea found her strengths in activism as irrelevant to the development of a more accessible video camera. This sentiment resurfaced when Carrie offered a nuanced critique: *"I want to make a distinction between the power that comes from sharing the things we have to do versus the fact that we have to do them. [These things we have to do] shouldn't have to happen. … Nobody [when presenting their biographical prototype] talked about systemic things or larger broader structure things. It's all micro. How can we broaden that in thinking about linking all those things together as a process across all of us?"* To Parker, Carrie, and Andrea, stories of invention, adaptation, and repurposing could foster negative feelings of inadequate skill and place too much focus on individuals with disabilities rather than wider structural forces that keep disabled people disadvantaged.

Nuancing Disability with Plural Identities
Finally, we consider the role of intersecting underrepresented identities in widening our narrow conceptions of disability. While a majority of our discussions centered disability, interest in communicating across varying identities organically emerged in conversation. What began as observations about participants' comfort level in what they perceived as an environment of sameness became an opportunity to mark generative difference. For example, Ahsoka, who is a cis woman explained, *"I think we can be more open with each other … because everyone's kind of on the same playing field here."* Tai who is genderqueer responded, *"I don't think we're all on the same playing field, it's that we're all on different fields and we're used to it."* This conversation created an opportunity for several participants who identified as queer and/or trans to speculate about attendee unification occurring not through common identification but through workshop conditions, such access-centered commitments that anticipate difference. Not having to justify the legitimacy of their varying lived experiences, in Ray's opinion, is what promoted vulnerable sharing. Ray who is a trans male summarized, *"Whether it be multiple disabilities, different marginalized communities, such as queer communities, people of color, we all have our separate groups, but we don't really seem to come together and explain how those marginalization's impact each other. And having to not have to explain multiple layers of issues [at the workshop] breaks down barriers to conversation."* Connectedness emerged in this discussion from acknowledging layered, intersecting modes of minoritized life. We learned that recognizing contributions by disabled people could, with the help of queer and other lived experiences, rework our categorical attention to disability. Recognition

then did not just apply to biographical prototypes, but to the multifaceted identities that contributed to sensemaking around disabilities themselves.

DISCUSSION

Across our workshops, we illustrated a means of recognizing design contributions by people with disabilities. We learned that oral or written stories interwoven with prototyping worked not just as auxiliary materials, but also as mechanisms for contextualizing the artifacts produced. We revealed feelings of exhaustion associated with making things work, and the complexities of sharing individual stories that may understate institutionalized oppression. We found that biographical prototypes opened space for talking about less comfortable aspects of storytelling around disability, such as unsolved or chronic challenges.

Upon closer inspection, we saw that the workshops also signified a deeper transformation for design practice and research. By developing and facilitating the creation of biographical prototypes, we took seriously the notion that disabled people are *always already* meaningful contributors to professional design practice. We materialized forms of counter-storytelling in order to change the circumstances by which the circulation of those stories might take place. Our workshops exposed how prototypes work not just as arguments [27], but also as ways of *memorializing* [78][79] — rehearsing particular forms of authorship (see Sami Schalk on crip futuring through speculative fiction [61] and Tavio Nyong'o on Afro-fabulation [44]). Through engaging with varied personal stories, participants began to imagine what they did not experience and reflect on the limitations of their imagination. For those who engaged with them, biographical prototypes helped shed aspects of a pejorative understanding of disability in favor of one that helped us sit with absences and obfuscation. They helped us challenge wider silencing in design research and even critique our methods of representing and recognition.

The most poignant of these critiques cautioned that biographical prototypes could focus narrowly on individuals in ways that risk asserting that people with disabilities should be responsible for their own adaptations. Celebrating design stories, then, may obscure the oppression underpinning their necessity and heighten the need for access as a standardized, collective practice. In other words, recognition alone can still promote the assumption that people with disabilities want to be associated with the design profession. Our attempt to address wider structural issues in professional design made some headway but left much work to be done [11].

Looking beyond our study, we reflect on these potentials and limitations of biographical prototypes in terms of how they help us shift the undue burden of *access* labor away from people with disabilities. In particular, we offer three insights for the work ahead:

1. **Foregrounding partiality**: Most importantly, biographical prototypes cannot work on their own. The prototypes hold onto partial connections and asymmetries as articulated by contemporary feminist theorizing [3], [18], [25], [29], [30]. They reflect moments in someone's life through rough representation rather than precise repetition or recreation. They are not meant to be comprehensive, authentic, or paradigmatic. Instead, they partner with their author for a brief and situated retelling. From the workshops, we learned the discomforts of this partiality needed more explicit acknowledgement for more holistic contextualization. Complementing workshop programs and individual stories with disability history and disability justice activism may provide precedence and credence for negative, unsolved, and untold stories.

2. **Prioritizing access-centered, plural (counter)-stories**: Biographical prototypes aim to bring close and uplift stories by systematically disadvantaged people to challenge commonly circulated stories — for example, accounts that portray people with disabilities as users, rather than possible inventors, of assistive technology. But design researchers must also take care to not enforce a particular counter-story. We learned our examples were not relatable to everyone, and that plural life experiences reworked our conceptions of disability itself. Insisting storytellers share a disability-centered story of making things work from their past may have silenced them. Instead, their biographical prototypes revealed much about themselves and prompted rich discussions both around and beyond design and disability. As such, we recommend centering access, not necessarily disability, so storytellers can choose which stories to tell.

3. **Recognition over obligation**: With biographical prototypes, we find it important not to assume that people historically under-recognized within design fields would be overjoyed (or even willing) to join the ranks of designers. We take up the language of *contribution* to mark a concern not for accomplishing a particular design goal, but for demonstrating acknowledgement and legitimation of the skillsets, intellect, and work that have been under-valued but have meaningfully scaffolded and composed professional design.

We offer these lessons as a means of emphasizing the significance of creating space for people with disabilities (as designers or otherwise) to learn about one another through prototyping. In helping us explore sites for recognizing often-hidden design legacies, they lay the groundwork for the refinement and elaboration of biographical prototypes in domains of work. But the commitments also suggest that the work of recognition does not provide an easy or straightforward solution to longstanding inequities. Instead, this work comes with its own incongruencies. A few participants in our workshops voiced having no interest in being designers, and many made a simple request: that designers

should build things accessibly. We find it both profound and troubling that this small request is still simultaneously such a large one. As researchers of Design and HCI, we need to make room for discussing why exactly people might shy away from defining themselves as 'designers' and what this preference says about our field of practice.

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