Accessible Crowdwork?
Understanding the Value in and Challenge of Microtask Employment for People with Disabilities

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ABSTRACT
We present the first formal study of crowdworkers who have disabilities via in-depth open-ended interviews of 17 people (disabled crowdworkers and job coaches for people with disabilities) and a survey of 631 adults with disabilities. Our findings establish that people with a variety of disabilities currently participate in the crowd labor marketplace, despite challenges such as crowdsourcing workflow designs that inadvertently prohibit participation by, and may negatively affect the worker reputations of, people with disabilities. Despite such challenges, we find that crowdwork potentially offers different opportunities for people with disabilities relative to the normative office environment, such as job flexibility and lack of a need to rely on public transit. We close by identifying several ways in which crowd labor platform operators and/or individual task requestors could improve the accessibility of this increasingly important form of employment.

Author Keywords
Crowdsourcing; accessibility; Mechanical Turk; employment

ACM Classification Keywords
H.5.3 [Group and Organization Interfaces]

INTRODUCTION
Crowdsourcing often involves doing microtasks—short jobs online for small payments. Crowdsourced microtasks have become integral to the information services economy, from matching images and product descriptions listed on commercial websites to transcribing a doctor's recorded notes. At the same time, microtasks offer a new way to organize labor, much like the technological innovation of the assembly line did at the turn of the Industrial Revolution. Job

requesters dismantle a single job into many microtasks that are completed by workers drawn from a group (crowd) via an open call. As such, crowdwork, designed with economic and technological efficiencies as well as human needs in mind, could transform digital labor, and more generally, the future of work.

Crowdsourcing platforms are often based on a simple model: requesters post tasks to be completed by workers online. Some of the major crowdsourcing sites for microtasks are Amazon Mechanical Turk (mTurk), CrowdFlower, and MobileWorks. Some of the most common types of microtasks that workers complete fall under the categories of transcription, translation, image tagging and classification, data collection, content generation (e.g., product reviews), and usability testing of websites [18]. While there are crowdsourcing sites that offer mobile jobs in the real world (e.g., TaskRabbit) [31] and some that offer larger, more skilled work opportunities (e.g., Freelancer.com, oDesk, 99designs), in this paper we are primarily concerned with microtasking sites.

Crowdwork may offer a unique proposition for people with disabilities, due to features such as the ability to work from home, avoid the frustrations of navigating inaccessible transportation, vary the pace of individual or multiple tasks, set a flexible work schedule, determine whether or not to reveal one's disability status, and use their personal adaptive technologies. In this paper, we explore whether or not people with disabilities are currently doing crowdwork, what motivates them to do so, and whether they are able to effectively and fully participate in this new form of labor.

This paper contributes the first research into crowdwork from the perspective of disabled workers. Disability status was self-identified by participants, and encompassed a range of short-term or permanent physical, cognitive, and/or socio-emotional challenges; as a first exploration into the participation of people with disabilities in crowdwork, we felt it was important to include a variety of perspectives and experiences. However, we acknowledge that the breadth of the generic "disability" label has drawbacks, such as the risk of missing out on key needs of specific subpopulations by focusing on commonalities among a larger group [7] – future work that focuses on experiences specific to particular

disability subpopulations (or compares and contrasts the experiences of crowdworkers with different types of disabilities) would be a valuable next step beyond the scope of the current article.

Using grounded theory, this paper follows an iterative data collection and analysis methodology to analyze the experiences of people with disabilities learning about and doing crowdwork. Following the grounded theory approach, we both discuss the implications of this at the macro level of disability rights and employment, and on the micro level by offering a range of different contextualized experiences and attendant implications for design. Drawing on critical theory [9], we argue that the discourse on digital accessibility is currently too narrow, and suggest that accessibility to digital technologies expand to include accessibility to employment and social experiences in computer-mediated environments.

RELATED WORK
We review the previous literature in the areas of disability and employment, crowdworker demographics, and crowdsourced accessibility applications. This literature review explains the theoretical framework of this paper and its interdisciplinary nature.

Disability and Employment

History of Legal Policies around Disability and Employment
During the 20th century people with disabilities repeatedly fought for legal protection against discrimination in employment opportunities. The landmark legal act for people with disabilities was the Americans with Disabilities Act (ADA). The ADA, enacted in 1990, made discrimination on the basis of disability to any employment, public or private services, accommodation, telecommunications, or transportation illegal. Although a landmark for disability civil rights, ongoing debates about the ADA's protective measures circulate on both the legal definition of disability as well as how to adapt the ADA to changes in the labor force and telecommunications sectors [28]. Though the ADA clearly prohibits discrimination in the areas of employment and telecommunications, we are unaware of prior research inquiring about the accessibility of digital labor or the experiences of those who self-identify as disabled who are doing crowdsourcing work.

Some of the primary ADA Title 1 goals are "ending employer discrimination, encouraging workplace accommodations, and making workplaces accessible" [20]. In 2011, researchers at Rutgers University and the National Bureau of Economic Research projected potential future work opportunities for people with disabilities. One major concern of their study was that people with disabilities would not be equally represented in the fastest-growing occupations; however, the study also noted that in the fastest growing occupations, not many required specific abilities (and therefore could be opportunities for people with disabilities) [20]. The researchers found that the increase of home-based work will be important for people with disabilities, enabling people to work regardless of transportation or medical issues necessitating people to stay at home [20].

The history of the struggle for equality in employment opportunities for people with disabilities is important in understanding how crowdsourcing can potentially offer a form of employment for people with disabilities. Furthermore, understanding the importance of accessibility to employment opportunities helps us understand how making crowdwork accessible means not only making sure the primary UI is accessible, but also the full experience of doing online paid work. Crowdsourcing offers a type of employment that, if designed with awareness of the challenges and diversity inherent in employing workers with disabilities, could offer people with disabilities an equal opportunity in the era of digital employment.

CDS and the Social Construction of Disability
Critical Disability Studies (CDS) is an interdisciplinary field of research questioning the history, current state of, and future of the full societal inclusion of people with disabilities. CDS explores disability studies drawing from the disciplines of anthropology, law, gender studies, social work, history, and others [6] [9] [22]. CDS also draws on critical theory, a school of thought originating with the Frankfurt school of philosophers from the 1930s, who argued for a critical look at societal practices and historical contextualization of current societal norms. Drawing on this, CDS scholarship challenges assumptions about the "able" body, and views the construction of disability as a cultural phenomenon [25].

From a framework of the social construction of disability, attaining employment is a critical part of participating fully in society for people with disabilities [20]. These perspectives see disability "as resulting from society's failure to adapt to the needs of impaired people" [1]. Recent scholarship coming out of CDS looks at the cultural construction of disability in the digital age [13, arguing that the design of technology is complicit in upholding a narrative of the normative, or "abled," person.

The idea of disability as a social construction is important to bring to the discussion on creating accessible technologies. It shows that there is a historical precedent to how disability is commonly talked about, understood, and experienced in both the accessibility of everyday devices as well as employment experiences. Furthermore, understanding how important employment can be to one's self-understanding as a social participant in society helps frame crowdsourcing work as an activity beyond an economic exchange.

The Demographics of Crowdworkers
While much of the literature on crowdsourcing focuses on the employer's perspective, in recent years scholars have begun to look at the demographics of people who perform crowdwork. Ross et al. [27] argue that the demographics of Amazon Mechanical Turk (mTurk) have been shifting from

moderate-income U.S. citizens to an increasing amount of international workers, especially young educated workers in India. Looking at this longitudinal change in demographics via a survey embedded as a HIT ("Human Intelligence Task," i.e., a single unit of microwork) on mTurk, Ross et al. argue that it may signify a shift from crowdwork as part-time to crowdwork as a full-time job. Ipeirotis [17] has also looked at the demographics of crowdworkers, focusing primarily on gender, income levels, and educational background; his work concluded that crowdworkers on mTurk largely mirrored Internet users in the U.S., with some biases (e.g. slightly younger, more females, slightly lower income, smaller families). He also found that for many workers in India mTurk work was a primary source of income, in comparison to workers in the U.S. where it usually served as complementary to other sources of income [17]. Both U.S. and Indian workers also shared secondary, non-economic motivations for performing crowdsourcing work, including entertainment and education. Our work builds on this literature by investigating a new demographic trait, disability status, which was not reported on in prior crowdworker demographies.

Martin et al. [23] analyzed posts on Turker Nation, one of the online web forums for mTurk workers. Their study went beyond looking only at primary motivations for doing crowdwork, also focusing on the "practical, emotional and moral aspects" of crowdsourcing – they found that earning a living wage was a key concern among forum posters. Our work builds on this by investigating whether wages are the key concern of disabled crowdworkers, as well, or whether other motivations may be more prevalent in this group, such as social interaction, entertainment, and/or education.

In the paper "The Future of Crowdwork," Kittur et al. ask whether they can imagine a crowd labor market in which they would want their children to work [19]. The authors outline the major challenges in crowdwork becoming a desirable work option for the middle class. Our work builds on Kittur et al.'s work by trying to understand the role of crowdwork as a potential meaningful source of employment to a group that is often relegated to low-status jobs in the non-digital world, and to understand how to make sure that digital labor for people with disabilities is not only accessible, but also fulfilling, fair, and respected.

Accessibility and Crowdsourcing
There is a large body of research on accessible technology, including studies of barriers to use with status quo technologies, interface design guidelines for more universal usability, and creation of novel software and hardware to facilitate usability for people with varying abilities. Beyond the research community, standards bodies like the World Wide Web consortium maintain accessibility guidelines (in this case, for websites: www.w3c.org). However, as our findings reveal, such standards do not adequately cover emerging online experiences, e.g. crowdsourcing workflows.

Recently, a number of researchers have studied how people with disabilities can be consumers (rather than producers) of crowdwork. The ESP game enticed workers to add descriptive tags to images (for fun, rather than for money); though the primary purpose of such tags was to enhance web search, they also held potential for making images more accessible to people with visual impairments [32]. Bigham et al.'s VizWiz application demonstrated that paid workers on mTurk could answer questions about photos for blind requesters in near real-time [3]. Brady et al. extended this work to examine whether members of a blind person's social network could provide a free source of this crowd labor [5]. Burton et al. examined the possibilities of using crowd workers to provide fashion advice to people with visual impairments [8]. Lasecki et al.'s Scribe system demonstrated that crowdsourced captioning for people with hearing impairments was cheaper and faster than professional captioning [21]. Hara et al. have explored using crowd workers to examine Google Street View images to identify features of a city that might impact a disabled person's navigation, such as whether sidewalks contain obstacles or how bus stops are laid out [14] [15]. Hong et al. have explored how people with autism can use crowdsourcing to receive advice about actions to take in particular social situations [16]. These projects have all examined how crowd labor can be used to improve quality of life for people with disabilities by doing tasks on their behalf – in contrast, our research considers whether participating in crowd labor as a worker, rather than a beneficiary of such work, is a valued and accessible experience for people with disabilities.

METHODOLOGY
For this project we used a mixed-methods approach to better understand the extent to which people who self-identify as disabled are doing crowdwork, their experiences with this work, and if their disability status interfered with task completion. Our method combined in-depth interviews (17) with broader surveys (631).

We used a grounded theory process to code transcribed interviews and qualitative survey responses [34]. We analyzed these data through open coding [11]. In contrast to quantitative coding, where interviews are arranged around themes connected to a theory that a researcher is interested in, open coding categories are not determined until after the interviews are finished: "qualitative coding is a way of opening up avenues of inquiry: the researcher identifies and develops concepts and analytic insights through close examination and reflection" [11]. The important methodological difference of analyzing interviews and qualitative survey answers by qualitative coding is that it allows for emergent themes, perspectives that the researchers may not have set out to find. It is a way of identifying significant experiences and observations. In this way, qualitative data analysis is iterative: what may have been important themes at the beginning may not make it into the final analysis.

The main author first performed open coding on the interview transcripts by labeling phenomena as they come to mind. From the collated list of phenomena, we created categories and cut-and-pasted related sections of interviews and qualitative survey data under the different categories. In grounded theory, analysis is an iterative process, and the labels of concepts and categories shifted through ongoing conversations between all of the authors. After we organized data under categories we did axial coding, which is a process of organizing categories and their sub-categories of data "to form more precise and complete explanations of their data" [34, p.124]. Some categories were split into subcategories, while others became less important as the paper evolved. The themes from these analysis are organized in the "Findings" section, and create the foundation for the thematic issues discussed in this paper.

Interviews
Interviews included eight people with disabilities and nine job coaches working at organizations that help people with disabilities find employment who are not disabled themselves. Interviews took place between December 2013 and February 2014, and were conducted in person when possible, or else via Skype. Interviews were recorded and transcribed for analysis. Interviewees were compensated $50 for their time.

The method of anthropological semi-structured interviewing values the unexpected themes that emerge throughout interviews, and prioritizes understanding the world from another's particular experiences and perspective. For this reason, interviews have a protocol, but every interview may not get to exactly the same questions. Particular peoples' experiences are important because they often complicate general ways of understanding an experience or phenomena. However, qualitative ethnographers are also always paying close attention to emergent patterns that are evidenced through shared narratives among groups of people.

Job Coaches
We initially reached out to job coaches in order understand the current ways in which people with disabilities navigate finding employment, the options for employment, and what job coaches look for in potential employment for clients who identify as having a disability. We identified job coaches by reaching out to local organizations that work with disabled populations, and by referrals ("snowball sampling") from job coaches whom we had already interviewed.

The job coaches we interviewed are full-time workers who match people with disabilities with jobs. Job coaching includes services such as job skills training, interview practice, resume building, and computer classes. These job coach interviews were a formative part of the research project in gaining an understanding of the history and current daily experiences of training people and placing people with disabilities in employment. The interviews aimed to learn about the current role of mediation by job coaching centers and training programs for people with disabilities, to learn about the requirements for job placement for people with disabilities, and to learn about how organizations who have worked with different disability populations for decades incorporate technology and view the role of computer-mediated work for disability employment in the near future. Some of the questions asked in job coach interviews included: *Have you ever heard of crowdwork? Do you have any clients who do crowdwork? Would you recommend this to future clients? How can you see crowdsourcing being a part of a job (i.e., educationally, transitional work)?* Of the job coaches, one had a client who did crowdsourcing work and one job coach had experimented with mTurk as a component of a computer skills class with a client; the other seven coaches were not familiar with crowdwork until we explained the concept.

There are many people who self-identify as disabled who hold steady employment, and many of these people never seek out help to find employment. However, in the U.S. job coaching organizations often work closely with government departments and programs, and hence are mindful of workplace accessibility and play an integral part of the social services offered to people with disabilities. Initially we thought that through contact with job coaches we could reach interviewees who had tried crowdwork. However, confidentiality kept the job coaches from directly putting us in contact with clients for interviews.

A related part of our methodology consisted of site visits to local job coaching organizations. We visited three job coaching offices in Seattle and were able to meet with employees and clients to gain an understanding of the workplace environment. The purpose of meeting job coaches in their environment was to gain a depth of understanding about the day-to-day environment for job coaches working in this sector as well as to understand the population of people who work at or attend job coaching centers. Of the three organizations we visited, one focused specifically on the blind population, and the two other organizations worked exclusively with people who self-identify as disabled, which included a range of cognitive disabilities, social anxieties, hearing difficulties, physical disabilities, and motor impairments.

Workers with Disabilities
We also interviewed eight people with disabilities who had experience with crowdsourcing work. There were six men and two women. The interviewees lived in five different U.S. states, including the west coast, east coast, midwest, and southwest United States. Two were between 18 and 24 years old, three in their forties, one in their fifties, and one in their sixties. These interviewees identified as having the following disabilities: blindness (3), Autism (1), other disability (1), severe social anxiety (1), serious health condition (1), combined type ADHD (1).

We recruited interview participants by advertising our study via a variety of media, including postings on online forums related to various disability interest groups, emails to

distribution lists for various disability interest groups, and social media posts from our organizations Twitter account that used the hashtag #a11y (a hashtag followed by many with interests in accessibility). We also made use of referrals ("snowball sampling") from other interviewees.

Interviews took 45 minutes and asked about the research participant's background, employment experiences, educational experiences, ideal work, general accessibility issues with technology, and experiences with crowdwork.

Survey

The in-depth interviews allowed us to gather rich qualitative feedback from a small sample of crowdworkers with disabilities. The emergent themes from the interviews then enabled us to create an online survey designed to complement our interview approach by gathering perspectives from a larger group of people.

We created an accessible online survey using SurveyGizmo's accessible template. The survey consisted of 30 closed- and open-format questions to gather both quantitative and qualitative data. Questions asked participants to identify their disability(ies) and any assistive technologies they used. Respondents were asked about their familiarity with crowdsourcing, and to indicate which (if any) popular crowdwork sites they had worked through. Respondents were also asked whether they had experienced accessibility-related challenges in performing crowdwork, and to describe any such incidents. Finally, participants were asked several questions about employment more generally, including their own employment history and their attitudes toward and goals regarding work.

The survey was administered over a two-week period in February 2014. We used the Cint service to recruit a panel of 500 U.S.-based respondents who self-identified as disabled (after manually identifying "spam" responses, 486 valid surveys remained for analysis). Respondents were paid a small gratuity to complete the survey. Note that respondents were recruited only on the basis of disability status, and did not need to know anything about crowdsourcing in order to take the survey.

Because respondents were completing an online survey, and because they were registered with an online recruiting service (Cint), they may be more tech-savvy and/or more likely to engage in online activities (such as crowd labor) than typical. To mitigate this possible selection bias, we also advertised the survey to several email lists, forums, and social media aliases relating to particular disabilities, resulting in an additional 145 eligible survey completions. Additionally, we placed a HIT on Mechanical Turk to attempt to recruit Turkers who self-identify as disabled; 83 Turkers completed the survey through this route. The trends among all three recruitment sources were similar (though the group recruited from mTurk was obviously familiar with crowdwork, unlike the other two groups), so our quantitative analysis of the closed-form survey questions focuses on the 486 respondents recruited by Cint, who represent a broader variety of disabilities than those recruited through email lists (which ended up drawing heavily from people with visual impairments, due to some of the authors' previous work with visually-impaired communities). Though relatively diverse, we do not anticipate that the Cint survey respondents are a statistically representative sample of disabled people in the U.S.; however, this relatively informal sample can provide insight into high-level questions about the challenges in and value of crowdwork for people with disabilities.

FINDINGS

We first provide an overview summarizing the backgrounds and interests of interviewees and survey respondents, followed by more in-depth, qualitative analysis of the interview responses and survey free-response questions.

Quantitative Summaries from Interviews

Of the nine job coaches, one had a client who did crowdwork, and one had a client who used crowdwork in a computer class. All of the job coaches were very interested in crowdwork, but none felt that right now they could recommend crowdwork to clients as employment. Rather, all of the job coaches indicated they would suggest crowdwork as an educational tool to clients, both for learning how to use technologies and for learning how to maintain a good working relationship with an employer.

Of the eight disabled crowdworkers we interviewed, four do crowdwork multiple times a week, three do crowdwork sporadically, and one tried it once. The four who regularly perform crowdwork use Amazon Mechanical Turk the most and do a variety of tasks. Some of the task examples given were image recognition, French translation, research surveys from universities, and tasks related to music.

Quantitative Summaries from Surveys

Disability: The types of disabilities represented among survey respondents are shown in Table 1. Many write-in descriptions in the "other disability" and "serious health condition" categories overlapped; sample common responses included arthritis, schizophrenia, and PTSD.

Disability	Respondents
Cognitive impairment	5.0%
Dyslexia/reading disability	7.9%
Blindness/low vision	12.7%
Motor/dexterity challenge	16.4%
Autism spectrum	4.4%
Deafness/hard-of-hearing	18.4%
Other disability	41.2%
Serious health condition	35.5%

Table 1. Self-identified disabilities of 486 survey respondents recruited through Cint. All participants had at least one disability, and some had multiple disabilities, so numbers total to greater than 100%.

Geography: 100% of participants currently live in the United States. Participants represented almost every state in the

U.S., with the exclusion of Vermont, Delaware, and Alaska. California residents represented 7.5% of the survey respondents, or 38 people. Florida closely followed with 37 respondents, or 7.3%.

Age: Table 2 shows the distribution of respondent ages; participants skewed older, which is not surprising given that many disabilities are acquired with advanced age.

Age	Respondents
14-17	1.4%
18-29	13.8%
30-39	11.7%
40-49	18.4%
50-59	28.1%
60+	26.5%

Table 2. Age distribution of 486 Cint survey respondents.

Gender: Female 57.4%, Male 42.2%, Transgender 0.2%, and prefer not to answer 0.2%.

Education: Participants represented a wide range of educational backgrounds, summarized in Table 3.

Education Level	Respondents
High school or less	5.0%
Some college/associate's degree	41.8%
Bachelor's degree	24.0%
Graduate degree	8.9%

Table 3. Highest level of education completed by the 486 Cint survey respondents.

Employment: Table 4 summarizes respondents' employment status. Unsurprisingly, a large proportion of respondents were not currently employed – Table 4 distinguishes between those who reported being unable to work due to their disability versus those whose unemployment was a more transitory state.

Employment Status	Respondents
Salaried Job	13.0%
Hourly Job	7.5%
Self-Employed	7.9%
Student	7.5%
Homemaker	9.3%
Retired	22.2%
Unable to work	32.8%
Unemployed (seeking work)	12.9%

Table 4. Employment status of the 486 Cint respondents.

Technology: 39.2% of respondents regularly use a device or feature on their computer or mobile phone to increase accessibility. These include speech recognition input, software or features to increase the contrast of the screen, screen reader software, keyboard accessibility features (e.g. Sticky Keys), and alternative pointing devices. 94.9% regularly use the Internet at home.

Employment considerations: 31% of respondents felt like they had been treated differently at a job because of their disability. Respondents ranked their top considerations for employment: 70.4% said that "loving what you do" was the most important aspect of a job, with salary (52.3%), flexible work time and place (45.1%) and health insurance (38.2%) following. 58.4% of people were interested in having a job search site specifically for people with disabilities.

Crowdwork: 12.4% of respondents had completed work on a crowdsourcing site. Among those who had experience doing crowdwork, the most commonly used platforms were Amazon Mechanical Turk (25 people), Clickwork (13 people), and MobileWorks (15 people). 18.8% of respondents who had tried crowdwork reported declining a crowdsourcing task in the last three months because they thought their disability would make it difficult to complete, and 28.1% reported facing a challenge completing a HIT due to their disability in the last three months.

Qualitative Findings

Using the qualitative open-coding methods described earlier, we identified several themes common in both the interview sessions and the open-ended survey responses (which asked survey respondents to describe any occasions when they had trouble completing crowdwork due to their disability and for thoughts on ways to improve crowdworking). However, we also indicate specific points of view that disrupt generalized ways of understanding an experience or commonly held belief. The main categories concern the accessibility of crowdwork and the tradeoffs inherent in performing at-home digital work.

We present the qualitative findings organized chronologically according to stages of the crowdwork process – learning about crowdwork, selecting tasks, performing tasks, completing tasks, and career prospects.

Learning about Crowdwork

One of the questions asked both in the surveys and interviews was how people learned about crowdwork. Many participants expressed excitement about the possibility of at-home work, and then disappointment with the real possibilities for crowdwork as a long-term employment option.

Participants shared a general feeling of satisfaction in finding real work online. In contrast to innumerable sites that offer points or an entrance into a survey drawing, participants found crowdsourcing sites unique for the quick and efficient payment. Other participants were generally excited about the idea of crowdwork and enjoyed it for aspects other than payment.

"*I was laying around ... or sitting around because I've made myself sit up. I don't let myself lay back anymore. I sit in the chair and I click, click, click all day, and I was playing video games is all I was doing. One day, I thought, 'You know, I've got to be able to make money somehow,' and so I put into a search engine, 'making money from home,' and just started*

going through, step-by-step, all of these different websites. mTurk is one of the ones that I found that you actually can make a little money. It's not big money, but it keeps me in … gas money for the car and the few little things." P4

"I heard about it from a friend of mine who's blind and who uses a thing called VizWiz. He was talking about and not the first time he talked about it, but the second time we did it and I just thought it was great. Obviously a real need, obviously something that was technologically fine, and that was sustainable somehow if you imagine some way of funding it. I just followed up. I just took a look at it. My French is one of the few things from my childhood that I can hold onto, at least my French text translation so I do a lot of that. Whenever I see a French to English translation I jump on it no matter what the rate is." P6

These quotes share a positive reaction to crowdwork both as a source of payment but also as a means to participate in new activities, or to continue a previous hobby.

Most participants felt as though crowdwork marketplaces (where workers search for jobs) were generally accessible. That is, the UI of the crowdsourcing sites worked well for the most part. However, a subset of workers (particularly those with visual impairments) did encounter accessibility issues with the homepages of the crowdsourcing sites. Getting past CAPTCHAs to create accounts was a common challenge for visually impaired workers accessing the site via screen readers (a well-known accessibility problem not unique to crowdwork platforms) [4].

"Actually, a friend of mine and I were talking about different types of jobs and she was also thinking about some sort of transcription job…All I can remember it was through Amazon, so I typed something like Amazon transcription job into Google and after a plummet seeing around for a couple of minutes I found it, The Mechanical Turk. I thought, 'This is an interesting concept.' So I immediately went to sign up and ran into one of those CAPTCHAs" P1

One worker reflects on running into an accessibility issue with her screen reader while signing up to work on Amazon Mechanical Turk. She reached out to customer service, and was happy with the response. However, the step of reaching out to customer service may be prohibitive for the participation of some individuals who may be immediately frustrated by the lack of accessibility:

"And I said, 'Oh crap, I'm stuck.' But I took a gamble and I emailed them and I said, 'I'm blind and I really want to work with you, but I can't do the CAPTCHA.' They actually broadcast it [the CAPTCHA] *for me which was the first time anybody has been willing to do that, so they got me in and I've been off and running ever since then. It was kind of neat."* P1

Selecting tasks
Identifying tasks that were a good match for their abilities was a challenge for our participants.

Even when a crowdwork platform itself was accessible (or a participant had become accustomed to how to navigate it sufficiently), tasks linked to third-party sites with varying interfaces and levels of accessibility:

"Even if you did put in like a little formatting [on a crowdsourcing UI] *maybe that site will be accessible, you can't guarantee in that third party.."* P3

Many tasks sounded achievable from their initial descriptions, but then partway through would involve an unanticipated component not suited to a participant's abilities. Multiple people expressed frustration with not being able to effectively filter HITs for accessibility. Participants started a task and halfway, or two-thirds of the way through, were unable to complete the task:

"There's one that's been happening where the whole thing works just fine until you get to the end and it's a set of demographics: enter your age, what was your education, that stuff and for some reason, it won't accept the selections. You'll make two choices and click next and it just get stuck and there is nothing you can do. Interestingly enough, they're the ones that have a link at the top that say, 'For an optimized version for screen readers, click here,' but it seems to be now that if I don't choose that option, I don't have that problem. I'm not sure what happened there but that's been the biggest and then of course some of the surveys will require you to look at a picture without giving you any description. It's like, 'Oh crap. I can't do that.' That's frustrating." P1

Workers were not only frustrated by the lack of compensation for their time on such "abandoned" tasks, but also concerned about the effects of quitting a task partway through, after accepting, for their reputations (reputation on mTurk influences a user's future task opportunities).

Performing Tasks
The issue of socializing (or not) while working was a key theme that emerged in discussions of performing crowdwork. One concern is that for specific disability sub-populations the social aspect of a workplace is critical for personal development. On the other hand, for people with social anxiety, at-home work became a space not dominated by social interactions, while at the same time social interaction over the internet remained possible.

While job coaches were generally concerned about the lack of socialization of workers with disabilities, participants who had worked in traditional settings did not share this worry. Some people disagreed with the assumption that digital socialization is not a form of socialization; they shared that crowdwork actually enabled them to feel connected to a broader national and global community.

For some people with social anxieties, a workplace exacerbates issues and the result is that people end up out of work. Crowdwork offers a compelling alternative, allowing people to participate in employment without the person-to-

person factor. One job coach described a client who has experience working in the customer support industry, but has a delay in voice communication that makes telephone support or interoffice communication difficult. The job coach expressed that the ideal job for the client is an at-home job of providing customer support in the form of text, either email or instant messenger. Another job coach talked about a client for whom working in a social environment is extremely stressful:

"I don't know if we've found her a job yet, but she has social anxiety, and I think this crowdsourcing, would be perfect for someone who wants to work, is okay interfacing over phone or computer, but not okay going out of her home." P8

However, some coaches expressed concern that avoiding challenging situations might not be the best way for a client to grow their skills:

"Mechanical Turk or other crowdsourcing opportunities might be good in those situations where students with autism and who have a social disability and it's really hard for them to get past those barriers, they wouldn't have to have that necessary contact that you would working in an office but at the same time a negative impact would be learning those skills and trying to teach those skills while learning on Mechanical Turk. I mean it doesn't offer too many face-to-face interactions so it wouldn't help us, as job coaches, to teach that social aspect of a job skill." P46

This following interviewee, who is visually impaired, shares the positive feelings towards digital anonymity as he reflects on respect while taking courses, or working, online. He currently crowdworks, but in this quote he draws on the comparison of taking college courses in person or online:

"The nice thing is the people that I work with in the class itself, the other students, the fellow students, had no idea that I even had a disability. They didn't even know that I was blind because everything is done online. My posts looked just like the next guy's posts. As long as you get your work done then nobody cares. That concept was really awesome because it was just neat – I was just another student just like everybody else. Of course, I'm working differently but I'm getting it done and who cares if I use a mouse or if I don't. I'm getting the work done. It was a really cool concept that way." P2

This theme of removing social tension by having a worker's disability status not be apparent to co-workers was echoed by another participant who was pleased that when microtasking the pace of his work would not be visible to other workers:

"Working online would be more comfortable than working in a public place due to the fact I am slower than other people" P10

Completing Tasks

In our surveys and interviews we asked: "Did you ever have a time where you started a task, and were unable to complete the task due to a disability?" Answers to this question revealed that working within a timed task was an issue across multiple types of disabilities:

"I was chosen to place a review in the time allotted to me but the words were too small and the machine I was using didn't have a magnifier so I kept getting sick and couldn't finish on time." P30

"I was working on a very long transcription job that I was allowed 12 hours to complete when I developed a high pressure headache (something you get with BIH) and I didn't think I was going to complete it in time because of the pain level." N33

A job coach tried crowdwork with a client as a way to practice computer skills. However, she felt that the frustration of almost completing tasks, and then running out of time, negatively affected her client's self-confidence and has since stopped trying to incorporate crowdwork:

"I think she did a business card one as well. Trying to do it in the time limit even though it seems like it might be a long time for her it really wasn't so she would get almost done and then it would time out and then she wouldn't be able to submit it so that got really frustrating for her." P46

Other participants, who couldn't complete tasks within the designated time limits due to a variety of disabilities, offered suggestions for changes in the design of the workflow to address this issue:

"To be able to accept 'chunks' of jobs that would not expire so fast." P40

"I would have more flexible time limits" P36

One interviewee sent an email weeks after her interview. The excerpt below expresses a continued frustration with task completion and concerns about this issue's impact on her reputation as a worker:

"In cases where a HIT has to be returned because of an accessibility issue I wish there was somewhere to be able to indicate that. I've had to return a bunch of HITs this week because halfway through there would be images I couldn't deal with or the survey would time out because sometimes it takes a little longer to make choices with a screen reader. I feel like that makes someone look bad as a worker when he or she has to return so many HITs which skews task completion statistics. I would like to be able to explain why or maybe have a second chance to try and complete the task. That probably is not possible to implement, but I thought I'd throw it out there for you." P1

On the other hand, one interviewee with a psychological disability expressed a history of getting severe anxiety regarding long-term work expectations. One thing that he liked about crowdwork is the ability to stop mid-task with no consequences:

"They're intermittent and they're short and like no harm no foul if you stop. If you stop you just stop, you don't have to explain yourself. This is what I was saying about expectations. It's really clear and it's very permissive. You jump in, you try it, and you finish it and that's it or you don't finish it and nobody comes screaming down the hallway at you. I don't think I looked at something and said, 'Oh this looks like trouble. I'm feeling anxious just looking at this task.' That's never happened to me. But...Yeah. There are times when I've just had a little tantrum or something and stopped." P6

Career Prospects

In this section we reflect on the economic and career prospects of crowdwork noted by people with disabilities. The ability to perform work at home, without the need to navigate transportation challenges, is a big plus in favor of crowdwork for this population, as is the ability to work part-time as a supplement to government disability benefits. However, job coaches described many of the key factors they look for when placing workers with disabilities in positions (such as health insurance benefits), which might limit the potential of crowdwork as a career.

Many workers expressed that the ability to do crowdwork work from home far outweighs the benefits of working in an office. The primary theme here is the stress of transportation to and from work. A job coach emphasized that transit was a key problem with placing people with disabilities with employment:

"Transportation, transportation, transportation. That is, I think, one of the biggest barriers is getting folks to where they need to be. If they can ride the typical bus and then that's usually not an issue. If they have to rely on specialized transportation and it gets you there either 45 minutes before your shift or 45 minutes after your shift, and picks you up 45 minutes early or doesn't pick you. That, I think, is a big issue." P8

People with disabilities who are covered by U.S. government disability payments expressed a range of emotions toward their motivations to do crowdwork. While many said it provided a valued supplement to their government payments, others said that they do crowdwork for fun and do not need the money. While no interviewees mentioned this, there is the risk that if people make too much money performing crowdwork they may become ineligible for disability assistance. Some people voiced frustration over the system of getting disability payments and others wished that stable at-home work opportunities existed so that they would not have to rely on government payments:

"[I would like to work at-home] to find out if there might be something I could do to earn a wage and supplement my social security disability." P19

All of the job coaches said that they would not, at this point, encourage crowdwork as a real career option for clients because they had guidelines for viable work opportunities which included providing health insurance. In the next quote, a worker who needs medical assistance to fix an injury talks about the frustration of trying to make ends meet through crowdwork and social services. While the lack of health insurance for those successfully on disability may be a non-issue, for people who are in-between and due to a physical injury cannot work, the lack of health insurance offered by crowdwork is particularly problematic:

"I don't even want to be on disability. I just need the insurance so that I can get fixed so that I can get back out into the workforce and be a productive citizen again. So, it's been highly frustrating … very frustrating. Meanwhile, I can't do a lot of things, but I can lay back on the bed, prop myself up [coughs], excuse me, prop myself up with pillows and get my arms settled just right, and I can go click, click, click on the mouse with one finger. It doesn't hurt. That's what got me started into crowdsourcing." P1

We asked job coaches how they match clients with jobs and what standards they have for a job for their clients. Our interest here was to understand how job coaching currently works for people with disabilities and whether crowdwork may be a future potential employment opportunity:

"They have to be permanent positions. They have to be a certain number of hours. We like to aim for 20 but we'd like to go with more if we can. They have to be an established organization and they can't be just in someone's home. It has to be actually a business. We like to involve people with inclusion in a workplace where they can have natural supports, a place where they can have a supportive manager, a place that's going to help work on their social skills, that's not going to stick them in the back, in a dark room somewhere." P45

DISCUSSION

This study was the first to look at the intersection of people with disabilities and crowdwork. Our findings illustrate that some people with disabilities are already participating in crowd labor markets as workers, that they participate for nuanced reasons that go beyond simple economic exchange, and that they face some challenges with respect to this participation. These findings lead us to re-interpret the meaning of "accessibility" with respect to crowd labor, to suggest design improvements for enhancing the accessibility of crowdwork platforms, and to suggest key directions for further research.

Unpacking Accessibility

Our interviews and surveys revealed that understanding the accessibility of crowdwork for people with disabilities was more nuanced than merely the accessibility of the UI of any particular piece of software they were using. Rather, accessibility seemed to operate at three different levels of abstraction.

The first level was what typically comes to mind when discussing accessible technologies – the basic usability of crowdwork software. In the case of crowdwork, this

included not only having the crowdwork platform itself having an accessible website, but also involved dependencies on all the third-party sites, software, and tools that were often embedded within requesters' tasks. For instance, on mTurk, Amazon only controls the interface used for tasks created with its frameworks – requesters are free to point workers to web pages that they have designed themselves, which may have their own accessibility issues.

The second level concerned the accessibility of the workflow of microtasking. Workflow-related accessibility challenges included identifying which tasks of those available would be most appropriate to a workers' abilities, managing multi-tasking and switching among several different apps and UIs, and dealing with inflexible time limits on tasks.

The third level regarded the accessibility of the new job experiences enabled by crowdwork. This involved challenges like learning about the availability of such work. In their book on "Employment and Work," Bruyere and Barrington [7] note the need for education programs for people with disabilities to impart skills needed for modern job opportunities; our findings build on theirs by revealing that meta-education (about the *types* of opportunities available, e.g., crowdwork) is also necessary, in addition to education related to specific skills. Job coaches seemed to view crowdwork more negatively than people with disabilities, suggesting a possible bottleneck on disseminating information about the opportunity of this new class of work. For people who do learn about crowdwork opportunities, do current reputation structures allow them to participate fully and engage with the most challenging and rewarding work? Our findings suggest that challenges with the workflow might negatively impact the reputation ratings of people with disabilities in a way that limits their ability to advance up the crowdwork ladder.

Implications for Design

Our findings reveal several concrete steps that platform designers and/or individual requesters could take to enhance the participation of people with disabilities in crowdwork. These suggestions could benefit platform operators and task requesters by increasing the efficiency of crowd labor markets (e.g., better matching of users with tasks, fewer abandoned tasks), and by enhancing their reputation as communicative employers willing to recognize the needs of a diverse pool of workers. Many of these changes would benefit all workers, not only those with disabilities, as is often the case with improving technology's accessibility. However, it is unclear whether such motivations alone, without platform or legislative policies to compel compliance, would be sufficient to motivate any actions that require extra work or changes in working style by individual task requesters.

Platform operators could improve the experience of finding tasks by introducing metadata fields that indicate what types of abilities a task requires (e.g., ability to work under time pressure, ability to view images, ability to hear audio, etc.);

alternatively, another set of crowdworkers could be employed to add such labeling to existing tasks, or, to some extent, this may be fully automatable (e.g., identifying which tasks contain captionless imagery, or which contain audio files). Recommender algorithms could be developed to identify tasks that require similar abilities to those already successfully completed by a given worker. Individual requesters could also take more care in providing descriptions of specific tasks to include ability-related details.

Adding the ability for a worker to easily "sub-contract" a component of a task to a different worker mid-task might be a solution for workers with disabilities who discover partway through a task that they cannot complete a particular aspect. Unfortunately, many microtasks cannot be further decomposed.

Platform operators could also provide an adjudication process through which workers with disabilities could seek to remove negative reputation points that have accrued due to disability issues, such as inability to complete a task due to improper description of required abilities or inadequate time allotments.

If platforms allowed people to optionally identify disabilities as part of their worker profile, such information could be used to automatically provide certain accommodations, such as extending time limits on tasks with flexible "due dates," supporting built-in microbreaks [29], filtering out inaccessible tasks, etc. Such profiles could also be useful for matching workers with particular disabilities to potential new crowdwork task types – if there is a significant presence of disabled crowdworkers, then software companies might be able to use such sites for crowdsourced accessibility testing of websites and services. However, evidence shows that people with disabilities have concerns about disclosing this information in other employment situations, and are unlikely to do so [2], which may limit the effectiveness of a self-disclosure based approach.

Developing an online community for crowdworkers with different disabilities could be valuable to this community. While not all workers are interested in identifying themselves publicly as disabled or interacting with others with disabilities, a substantial percentage of our survey respondents indicated interest in employment websites targeted to people with disabilities. Such a forum could help with disseminating information about available opportunities, curating reputation of requesters and platforms with regard to their accessibility, organizing for policy and lobbying purposes, and providing a space for a different kind of social interaction surrounding the work experience.

It is unclear, both legally and ethically, to what extent crowdsourcing platform operators versus individual task requesters should be responsible for ensuring the accessibility of tasks. For example, should platforms require

compliance with certain standards before allowing a requester to post a task, or should they modify their APIs in a way that makes it easier to create accessible HITs and harder to create inaccessible ones, or perhaps create clear instructions and guidelines for requesters about accessible task design? Even though current U.S. law does not require this, it may be something crowdwork platforms ought to consider for ethical reasons, to broaden their potential participant base, to enhance their task completion rates, and/or to stave off potential future legal actions.

Future Directions

Our findings suggest several areas that warrant further investigation. An important avenue for future research is about understanding the level of representation of people with disabilities—in general and for specific disabilities—in this category of employment as compared to people without disabilities. This would involve more representative sampling than was done in this initial study, and would help answer questions about whether people with disabilities are adequately, under- or over-represented in this type of work.

Our research focused on people with disabilities participating in microtasking. An important avenue for future research would be to investigate the level of representation in higher-skilled crowdsourcing work such as oDesk and Freelancer. Such research may elucidate whether or not similar accessibility issues exist for the contract work population, as well. Throughout our research we met some people with disabilities who worked on higher-skilled contract sites, but we did not focus on collecting data on contracting crowdsourcing work.

Another possible avenue for research is to understand how crowdworkers with disabilities are currently interacting together and helping one another. A related direction is a comparative project on the accessibility of different crowdwork forums. Such a research direction would facilitate understanding whether accessibility to crowdwork is a platform-specific issue or whether it is a more systemic issue. In particular, it seems that platforms that allow for greater flexibility in task design by allowing requesters to point workers to their own web pages may also be at greatest risk for high variability in the experienced accessibility of the platform.

Our research found that people of all ages with a range of disabilities are performing crowdwork. Different disability sub-populations faced different challenges in crowdwork. Future research looking at how specific disability sub-populations are using crowdwork – such as the elderly, people on the autism spectrum, etc. – will be important in understanding changing crowdworker demographics. One promising aspect of crowdwork for the disability population is the possibility to work from home, set one's work hours, and manage social interactions. We share Kittur et al.'s suggestions for future research looking at how to build a) a career ladder, b) continuing education, and c) stability into

future crowdwork UIs. Such research will be critical in order to make crowdwork a viable long-term option.

CONCLUSION

This research offered a first look into the participation of people with disabilities in an emerging form of digital labor – microtasking on crowdsourcing platforms. Through interviews and surveys, we demonstrated that people with disabilities are already participating in this new labor system, and identified some of the advantages and challenges they encounter through this type of employment. We reflected on how accessibility of digital work involves more nuance than the mere accessibility of a particular crowdsourcing website, and on design steps that employers can take to address the challenges identified by our participants. Full access to participate in emerging forms of labor is important not only as an economic opportunity for people with disabilities, but as a social recognition of their full participation in all aspects of society; our work has highlighted important considerations for platform operators, job requesters, and policy makers to consider as a next step along the path to making this full access a reality.

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