

Designing Trans Technology: Defining Challenges and Envisioning Community-Centered Solutions

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ABSTRACT

Transgender and non-binary people face substantial challenges in the world, ranging from social inequities and discrimination to lack of access to resources. Though technology cannot fully solve these problems, technological solutions may help to address some of the challenges trans people and communities face. We conducted a series of participatory design sessions (total $N = 21$ participants) to understand trans people's most pressing challenges and to involve this population in the design process. We detail four types of technologies trans people envision: technologies for changing bodies, technologies for changing appearances / gender expressions, technologies for safety, and technologies for finding resources. We found that centering trans people in the design process enabled inclusive technology design that primarily focused on sharing community resources and prioritized connection between community members.

Author Keywords

Transgender, non-binary, participatory design, technology design, community, safety, resources, LGBTQ+

CCS Concepts

•**Human-centered computing** → **Human computer interaction (HCI); User centered design; Participatory design; Empirical studies in collaborative and social computing;**

INTRODUCTION

People use social technologies to integrate themselves into the world, and often to understand their own personal and social identities and to find resources that support those. Though people change and grow in substantial ways throughout their lives [50], most technologies are not designed to meaningfully consider change and transition. This causes difficulties especially for people who are transgender and/or non-binary (shortened to “trans” for the remainder of this paper), a population who faces unique experiences in everyday life due to

1) the process of gender transition, which involves a series of social and sometime physical and legal changes that may take months or years [4] and 2) substantial challenges such as transphobia, discrimination [37], violence [56], algorithmic bias [35, 49], and lack of resources [14] that influence their wellbeing and opportunities in the world. Being trans and using technology brings up many challenges because technologies are generally not created with the intention of including trans people and supporting their experiences [1]. In this study, we sought to understand challenges trans people face, and how technology can be designed to support these needs and challenges. This is a first step toward creating technologies specifically for and with this population in the future. Such *trans technologies* could range from online spaces like social media sites to wearable technologies, physical technologies, or even form-altering technologies. We set out to answer the questions: *How can technology best support trans individuals and communities, and meet their needs? What types of future trans technologies do trans people envision?*

To address our research questions, we conducted three participatory design sessions with a total of $N = 21$ participants in two U.S. cities. Through these sessions, participants first worked together to identify the primary challenges facing trans and non-binary individuals and communities. They then worked on a collaborative sketching activity to think about and explore potential technological solutions to these problems. While technology cannot solve the social injustices that trans people face in the world, technology can be a tool to help improve people's lives both day to day and in the long term. In this paper we contribute 1) a community-driven categorization of challenges faced by trans people in the U.S. and 2) a set of ideas and sketches for technological solutions, collaboratively generated with the community, to address challenges faced by trans and non-binary people and communities. These solution ideas are divided into four themes, based on our qualitative data analysis: technologies for changing bodies, technologies for changing appearances / gender expressions, technologies for safety, and technologies for finding resources. Importantly, many designs participants envisioned involved a community aspect, such as sharing community resources and prioritizing connection between community members.

BACKGROUND AND RELATED WORK

Trans is defined as having a current gender different than that assigned at birth. Importantly, a person's relationship to their

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CHI '20, April 25–30, 2020, Honolulu, HI, USA.

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DOI: <https://doi.org/10.1145/3313831.3376669>

gender is what matters, not necessarily physical changes. Non-binary genders are those outside of the binary man/woman genders. Trans is an umbrella term that includes non-binary trans people, though not all non-binary people consider themselves trans. We use both terms throughout this paper. However, when we use the term “trans,” this intentionally includes non-binary people - for example, trans technologies are technologies for trans and/or non-binary people. In fact, the majority of participants in this study were non-binary. While some technologies will work differently and serve different needs for trans people with different orientations towards the gender binary, we present trans technologies that participants envisioned without imposing divisions between different types of non-cisgender identities.

To situate our work in the broader literature and technological practice, we review existing work related to technologies designed by and for trans and non-binary people to support their needs and address challenges faced by this population. We also review several “anti-trans” technologies that cause harm to trans users, to highlight opportunities for technology to do better.

Trans technologies

Haimson et al. [31] defined trans technology as technology that “allow[s] trans users the changeability, network separation, and identity realness, along with the queer aspects of multiplicity, fluidity, and ambiguity, needed for gender transition.” We highlight several existing trans technologies in six categories: identity, safety, resources, community, games, and the Internet itself.

Some trans technologies involve highlighting aspects of trans **identities** and experiences, sometimes using artistic means. Shabbar implemented a critical art project called Queer-Alt-Delete that used “algorithmic uncertainty” to challenge gender binaries and cisgender-imposed surveillance systems [51]. Cárdenas [12] used virtual realities to make trans identity “real” by inhabiting multiple identities across time and space. In some ways, trans people’s practice and potential of shifting and existing multiply combines bodies with technologies of change [47].

Technology to support **safety** is an important and under-designed category of trans technologies. Given the substantial violence faced by trans people and communities in both online and physical world settings [24, 37, 48, 55], technology could help to improve safety conditions. Scheuerman et al. [48] argued that technology design can be an important means to combat abuse and increase access to spaces that trans people often cannot access due to safety concerns. As one example of technology design to support trans safety, Starks et al. [58] designed U-Signal, a prototype wearable technology and mobile application to increase trans women and non-binary people of color’s safety by enabling them to alert safe contacts when facing physical safety threats.

Several sites and apps aim to provide **resources** for trans people, many focused on health. MyTransHealth is an online resource to help people find trans-competent health providers in six U.S. cities [43]. The Solace app helps trans people track

transition progress and find resources (e.g., legal, medical) to guide them through transitional stages [54]. Refuge Restrooms [45], and the accompanying YoRestrooms app [70], collect and disseminate crowdsourced information about trans-friendly restrooms. Beirl et al. [5] developed and designed an app that helps trans people use gendered public restrooms by signifying that supportive people are in those restrooms. Trans people use voice training apps not only to train their voices, but also to reflect on their voice in the present and past [1]. Finally, Transbucket is a website designed to enable trans people to share photos of their results post-surgery [65], addressing the population’s need for information about their healthcare options (e.g., which surgeon to choose). While many online sites censor such content, Transbucket is a space where people can share “explicit” content, which is medical and educational in this context, without fear of censorship.

Other sites aim to build **community** or connection for trans people through social media, online dating, social networking, technology design, entrepreneurship, and employment. Trans Time is a social media site developed for trans people to document transition and find community [64]. Previous research has argued that, before its 2018 policy changes that prohibited “adult” content, Tumblr was in some ways a trans technology given its support for people to present multiple identities in a space away from existing networks and its lack of censorship [28, 31]. Finally, Transdr is a dating app designed to enable connections between trans people and “their admirers” [66]; however, it is unclear to what extent the app serves trans people’s needs rather than fetishizing them [27]. Other trans-centric dating sites have been designed in the past (e.g., TransPeopleMeet), but have so far not achieved their goals. Trans*H4CK is a “mini-incubator” that aims to empower trans people to create technology and pursue entrepreneurship [67]. TransTech Social Enterprises is a trans-led co-working / co-learning community with a goal of helping trans people gain skills and employment [22], though its practices have been critiqued [17].

Many digital **games** are created by and for trans people, particularly trans women, or at least include trans characters [39, 46, 52]. Kopas [39] claimed that “hypertext and digital games are totally trans genres,” and described how wrestling with code to make it work to portray the game as the developer desires is similar to the trans experience of wrestling with one’s body to become something that makes more sense to oneself.

It may be that sometimes the **Internet** itself is or was a trans technology, in its capacity to enable change and multiplicity, as documented by [6, 14, 69]. At a point in time when the Internet was more of a space for changing and fluid identities, Stone [60] argued that online, the “transgendered [sic] body is the natural body.” If, as in Stone’s [59] view, technologies can extend a person’s self and agency (what she calls “prostheses”), then perhaps any type of technology that a trans person uses to project part of themselves into the world could be considered a trans technology to some extent.

Anti-trans technologies

Because of the harm some technologies cause to trans individuals, certain technologies can be considered “anti-trans.”

Automatic gender recognition systems not only exclude many trans people due to binary classification systems and conflation of gender with physical characteristics, but also cause risk, harm, and oppression to those who are misclassified or fear misclassification [33, 38, 49]. Similarly, U.S. Transportation Security Administration (TSA) airport technologies that attempt to enact security by classifying bodies as male or female problematize trans bodies, cause distress to trans people, and limit trans people’s mobility [16, 3]. Computerized methods of documenting identity (e.g., ID cards, administrative systems) can enable algorithmic bias and administrative violence against trans people [35, 56]. Credit reporting technologies similarly render trans people illegible, and link past data with present and future data in harmful ways for those whose identities have changed over time [41]. Such technologies create negative financial implications for trans people, who often find themselves ineligible for credit due to mismatches between identities or the need to “start over” to escape past data [41]. “Gig economy” technologies like Uber also exclude trans users due to constant re-verification of credentials which rely on drivers licenses, a document often unavailable to trans people and that privileges static identity presentation [68]. Tinder disproportionately bans trans women from its site, as a result of other users reporting and blocking their accounts [36]. Spiel et al. [57] documented the myriad ways non-binary people are often further marginalized by technological systems. Finally, several studies have described the ways that Facebook sometimes harms trans users, such as by reinforcing binary gender options on the infrastructural level [7], enforcing real name policies [32], and creating a system in which identity persistence is linked to authenticity [30, 32]. However, it should be noted that Facebook’s gender options have become substantially more inclusive over time, and Facebook is a site where many trans people find support during transition [29]. New trans technologies can be designed to counter some of the harms prevalent in anti-trans technologies.

Participatory design and LGBTQ+ people

Several studies have used participatory design methods in studies with LGBTQ+ people to design with and for this population. Gatehouse et al. [24] conducted participatory design sessions with LGBTQ+ young people to understand how to design technology for hate crime reporting, Pereira and Baranauskas [44] used a participatory co-design process with LGBTQ+ people to design an application to support safety and support, and Marcu et al. [42] designed with LGBTQ+ youth to create a smartphone application to improve HIV medication adherence. Hardy and Vargas [34] conducted participatory design sessions with rural LGBTQ+ people to understand this population’s unique technology needs. Similar to the present study, participants envisioned technology that would make resources visible [34]. Yet designs also focused on community visibility [34], a theme participants in our study did not center. Brulé and Spiel [11] examined how researchers and participants bring aspects of their identities, such as gender and disability, into participatory design sessions. They argued that researchers should use a systematic reflection process to enable identities to emerge, whether or not a study is particularly focused on gender or disability [11]. To our knowledge,

previous participatory design studies have not focused specifically on trans populations. Prior work has demonstrated the value of participatory design in the context of LGBTQ+ people broadly. We extend this work by using participatory design methods to draw from trans people’s insights and work with them to envision solutions to challenges the community faces

METHODS

When attempting to create technology specifically for trans people, it is important to ensure that their input is taken into account. Participatory Design is an approach to designing technology that intentionally includes users in the design process to ensure that user viewpoints are taken seriously and user needs are met [53]. To understand how to design trans technologies and what types of technologies to design, we held a series of design sessions with trans people to understand what they want and need from technology. In designing with a marginalized population, we paid particular care and attention to context, engagement with the community, and participants’ intersectional identities [23]. This study was approved by the University of Michigan Institutional Review Board.



Figure 1. Participants collaboratively sketching at a design session. Participants explicitly gave permission for photographs to be taken and published.

Future-making through design

In our design sessions, we intentionally focused on future-making, which Ehn et al. [21] define as “multiple futures imagined and made locally, in heterogenous communities, and with marginalized publics.” A “future workshop” includes brainstorming a list of critiques to the current situation (in this case, challenges trans people face in society and in many areas of life) and then transforming those critiques to positive outcomes [9]. This results in a utopian set of ideas without limiting those ideas to what is real or practical [9]. Our future-making involved a collaborative design process with diverse stakeholders in which we established trust, respected each others’ opinions, and facilitated mutual learning [21]. Our concerns and goals centered on gathering a group of community members to learn and design together while addressing challenges that these people and their communities face (more so than the technological aspects of the designs) [21]. Guided by Bratteteig et al.’s [10] principles for addressing power, our sessions were a collaborative setting where participants created and expressed their ideas and visions through

three steps: identifying problems, envisioning design ideas, and concretizing ideas through sketching. This approach encompasses some aspects of research through design, which includes reflection and reframing of a problem, and “a shift to investigating the future as a way of understanding the world that should be brought into being” [71]. Bannon et al. [2] argued that researchers should use participatory design to increase equity in the world. Through future-making, we work with participants to collaboratively envision futures that can help reduce inequities faced by trans people and communities.

Recruitment

We recruited participants through community and support groups and listservs for trans people in and near Ann Arbor, Detroit, and nationwide, as well as via our own social media networks. Our recruitment materials stated, “Are you 18+ and transgender, non-binary, or another non-cis identity? Influence the design of future social technologies to benefit transgender and non-binary people, and receive \$40,” provided additional information about the study, and included a link to our screening survey. The screening survey asked demographic information and whether people would be available to attend a participatory design session in Ann Arbor, Detroit, or at the Trans Wellness Conference in Philadelphia. The screening survey received 91 total responses. We contacted a diverse sample of participants in each of the target locations and invited them to attend the sessions, and also recruited participants in person at the Philadelphia Trans Wellness Conference. We held three design sessions in summer 2019: two in Ann Arbor and one in Philadelphia during the conference (see Figures 1 and 2). We ensured participants that their data and identities would remain confidential. All participants gave explicit permission to be photographed and for their photographs to be published.



Figure 2. Participants sharing their sketches at a design session. Participants explicitly gave permission for photographs to be taken and published.

Participants

Participants were 19% trans women, 14% trans men, and 71% non-binary. Regarding race/ethnicity, 62% were white, 24% Black, 14% Latinx, and 10% Asian. Percentages add up to

greater than 100% because some participants were in multiple categories. 48% of participants were 18-24 and 52% were 25-34. Each participant was compensated with a \$40 gift card, and we also provided snacks or a meal during each design session.

Design activities

We planned a series of activities to elicit design ideas, both in writing and in visual format. At the beginning of the sessions, we distributed materials for participants to use in the design activities: paper and index cards of various sizes, many different types and colors of pens and markers, and stickers. We began with introductions, in which participants shared names, pronouns, and salient aspects of their identities. In the first session we used a “trading cards” activity [26] for introductions, but removed this from subsequent sessions to allow more time for the other design activities. We then collaboratively established group norms and communication preferences (e.g., make space / take space, “throw glitter not shade,” check your privileges). We then described the workshop’s purpose, both verbally and on a slide: “to influence the design of future social technologies to benefit and center transgender and non-binary people” and to “develop technologies using a community-centered framework.”

Next, we asked participants to brainstorm challenges faced by trans individuals and communities with the prompt “What challenges is our community facing?” Participants first wrote challenges down on post-it notes, and then we engaged them in an affinity diagramming exercise (primarily led by participants) in which the post-its were organized into broader themes of challenges, with the prompt “Let’s group these challenges into themes / categories” (see Figure 3). Participants were then asked, “Which category of challenges resonates most with you?” and instructed to choose a challenge category to focus on in the next activity. Next, we led participants in a brainstorming activity [25] in which we asked “What ideas come to mind when we say trans technology? How might technology address some of the challenges that we discussed?” Participants wrote their technology design ideas on index cards, and then passed the index card to the person on their right. We asked participants to read the previous person’s idea, and then “Building on that idea, write a new idea below it.” We repeated this process several times, until each index card included four or five people’s ideas. Finally, participants collaborated on a “Drawing Together” activity [63] combined with a 1/2/All approach (adapted from 1/2/4/All [62]). Participants chose an index card with ideas that inspired them, then first sketched their design ideas individually (prompt: “What idea stuck out to you from the notecards? Based on that idea, draw what that technology might look like to you.”), then sketched in pairs (prompt: “Pair up with another person. Discuss your ideas and sketches. Choose one of them, and together draw what that technology might look like to you”), and then presented their design sketches to the full group. Design sessions lasted for two hours each.

Data analysis

We collected audio data from the design sessions, which was transcribed for data analysis. First, three authors separately

coded audio data alongside physical data from one session (sketches and notecards) using inductive open coding procedures to enable codes to emerge from the data [15]. Three authors then met to discuss the codes and organize them into themes using axial coding [15]. Two authors then coded transcripts and physical data from each of the two remaining sessions using these codes and themes. Finally, three authors met to discuss the codes and themes, resolve instances where the coders disagreed, reorganize codes and themes as needed, and determine a final mapping of how the codes and themes related to each other. Through this process, we settled on the themes presented in this paper: technologies for changing bodies, technologies for changing appearances / gender expressions, technologies for safety, and technologies for finding resources. “Challenges” was another theme coded in the data, but the mapping of challenges came primarily from collaborative affinity diagramming during the design sessions.



Figure 3. One category in an affinity diagram of challenges faced by trans individuals and communities from one of our design sessions.

RESULTS

Using participatory methods, we set out to understand how technology can be designed to address some of the challenges faced by trans individuals and communities. We first detail the challenges that participants described as particularly salient for trans people. Then, we describe the solutions participants envisioned, via brainstorming and sketching, to address some of these problems. Solutions fell into four categories: technologies for changing bodies, technologies for changing appearances / gender expressions, technologies for safety, and technologies for finding resources.

Challenges

During the design sessions, participants identified dozens of challenges that trans individuals and communities face. Through the collaborative affinity diagramming process, we

and participants settled on thirteen broad categories of challenges:

- **Access to society** (e.g., access to restrooms, being safe/welcome in physical spaces)
- **Financial/employment challenges** (e.g., financial disparities, barriers to employment, binary job applications, lack of trans-inclusive workplaces)
- **Gatekeeping** (e.g., not feeling “trans enough,” transphobia within LGB spaces, exclusionary behaviors, non-binary erasure, pressure to disclose)
- **Healthcare** (e.g., lack of trans-competent providers, access to insurance, addiction, HIV)
- **Housing** (e.g., housing discrimination, affordable housing, homelessness)
- **Lack of access to resources** (e.g., healthcare, housing, food, education, clothing)
- **Lack of respect for one’s identity** (e.g., people using incorrect names and pronouns, forms with only binary gender options, systems that do not allow name changes)
- **Online identity** (e.g., difficulty of expressing trans identity online, privacy and anonymity challenges, “real name” policies, sites that do not allow name changes)
- **Police** (e.g., police violence, harassment by police, targeting by police, incarceration)
- **Pressure to educate cisgender people about trans identities** (e.g., lack of existing educational resources, lack of media representation)
- **Racial injustice** (e.g., white supremacy, anti-Blackness, transmisogynoir [40])
- **Violence** (e.g., murder of trans women of color, sexual assault, harassment, coerced prostitution, domestic violence)
- **Miscellaneous challenges** (e.g., lack of access to trans history, trans experiences being marginal to cisgender experiences)

While the challenges trans people face have been well-documented in past work (e.g., [4, 8, 37]), a community-driven mapping of these challenges, in the context of a technology design session, is new. Out of these categories, participants decided to sketch technology designs that addressed the following issues: access to society, healthcare, lack of resources, lack of respect for one’s identity, and violence. This resulted in our four themes of technological solutions. Though the solutions participants envisioned were not necessarily the most high priority challenges facing the community, they lent themselves better to technology design than some others (e.g., racial injustice, financial challenges). In what follows we present the ideas and designs that participants developed to address some of the challenges faced by trans and non-binary communities.

Technological Solutions

Participants collaboratively brainstormed, sketched, and described ideas to try to address some of the challenges they identified. Many design ideas solved more than one challenge. Often participants spoke directly from their lived experiences when designing technologies, adding depth to the process.

Technologies for Changing Bodies

Healthcare affordability and accessibility were challenges frequently mentioned by participants. Thus, many participants

focused their design ideas and sketches on technology that would enable them to change their bodies. Giving participants the space to express their full creative desires allowed many of them to think outside the box and design exciting speculative technologies that, while perhaps not possible to build given present technological and biological constraints, bring insight to trans experiences and technology's place in improving trans lives.

Body-changing laboratory. Participants throughout the design sessions expressed the need to have autonomy over their gender expression regarding their physical body, and envisioned a technology to address this (see Figure 4). Coe and Meridian (all participant names are pseudonyms, except cases where the participant wanted to be identified) desired to build a laboratory where “you can step into a machine and it will let you change and re-shape your body” (Meridian). In Coe’s words, this machine “allows us to apply, for lack of better words, whatever it is that you would like to apply or enhance on yourself.” Although gender confirmation surgery happens frequently in trans communities, what makes Coe and Meridian’s design proposition different is the technological, do-it-yourself nature of a body-changing laboratory. While this design idea is clearly speculative and may not be technologically feasible, it provides important insight into the need to give trans people more control and agency over their transition-related healthcare needs.

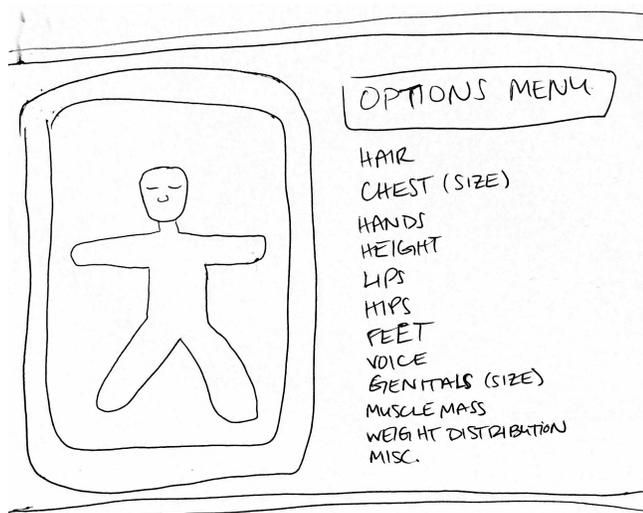


Figure 4. Body-changing laboratory sketch by participant.

Body sharing. As an alternative to Coe and Meridian’s machine technology for changing one’s body and affirming one’s gender, Ryder proposed a design that envisions a more collaborative and community-based body-sharing process. Ryder stated that trans people could use “technology to give body parts to others, i.e., giving boobs to trans-femmes who want/need them.” Unlike Coe and Meridian, Ryder designed their body-sharing technology with the hope of collaborating with healthcare providers. Ryder describes how after surgery, the technology would

transport unwanted body parts to others who may want/need the body part done by affirming healthcare providers. The technology can zap parts to other places easily, painless. None of the parts are labeled in binary ways, and the technology automatically matches blood types so no risk of organs/parts being rejected. It also ensures that body parts are racially appropriate, no tea, no shade.

Many participants expressed having negative experiences and/or stories about past and current healthcare providers, so involving affirming providers was key. One particular challenge participants faced was not being able to afford insurance, which impacted their ability to have the surgical procedures they desired. To address these challenges, Ryder built a funding model into the technology design: “It’s fully funded by the government so no health care is needed.”

Nanobots. In addition to their body-sharing ideas, Ryder also talked about addressing medical diseases that affected trans and non-binary people. They created a design involving “nanobots that sees unaffected cells, made affordable to those with no insurance or cannot afford insurance.” Nanobots, as of yet purely hypothetical, are minuscule robotic devices that can be used for medical tasks at the cellular level. Addressing both the medical challenges as well as the social challenges that come with medicine, Ryder, a Black non-binary person, talked extensively about wealth and the legacies of white supremacy, stating that these technologies should be “affordable and accessible to all, so not just the wealthy and the white” and should “not be affected by the medical industrial complex.” Participants in our study grappled with the historical effects of medicine on trans communities, challenging themselves to come up with technology designs to address those effects.

Technologies for Changing Appearances/Gender Expressions
While the previous section focused on technology design for changing bodies, this section will tackle the ways participants addressed additional changing appearances and gender expressions. From unique clothing design to reality-shifting interactive mirrors and glasses, participants theorized designing technology for gender affirmation in different ways throughout the design sessions.

Shifting clothing. While some participants thought of wearable technology as digital, other participants considered physical approaches to wearable technology design. Many described experiences with not being able to buy clothing that was particularly catered for trans people, and described ways to design clothing to address trans-specific challenges (see Figure 5). These ideas included menstrual pads tailored to pants and shorts for trans men and non-binary people, and changeable patterns on t-shirts to display the fluidity of one’s gender or to disclose one’s trans identity in some settings but not others. Mani described a fluid form of wearable technology that

changes the appearance based on what you prefer at the moment. So it can have a padding illusion, or binding, you can change the pattern of the clothing as well as the shape like whether you want a dress or tank top or shorts.

Avon stated,

on the whole transformable clothing idea, ...it reminds me of those pull-out beds that turn into couches. I mean, maybe a practical thing could be just clothes that could be folded or manipulated in such a way so they could be a different shape. It doesn't necessarily have to be that high tech... If there's reversible coats I'm sure that idea [could be] taken in another direction.

Using inspiration from things they saw in their personal life whether it was pull out couches to costume design, even runway modeling, Avon and others pulled ideas from an array of sources. A final idea by Joanna involved a necklace with interchangeable pronoun labels that would flash in certain colors when a person was misgendered, and includes a smoke screen canister that enables the wearer to disappear if necessary (see Figure 6).

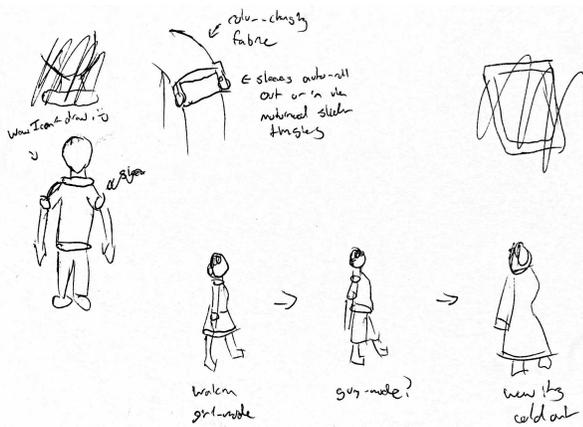


Figure 5. Shifting clothing sketch by participant.

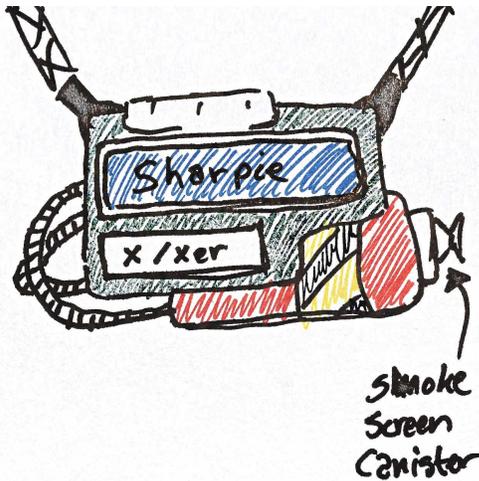


Figure 6. Pronoun necklace sketch by participant.

Augmented mirrors/glasses. Participants envisioned mirrors and glasses that could change a person's view of themselves or their experience in the world (see Figures 7 and 8). Coe and

Ren extended the body-changing design ideas, suggesting augmented glasses and/or mirror technologies that allow a person to view themselves as they envisioned their gender, and to see how potential body changes would look before actually going through with the procedures: "you start by seeing in a mirror so you can change how you want to see it first before you go into the machine and change it" (Coe). Another technology idea involved stepping into a booth, altering one's body in whichever way one desired, and stepping out appearing the way they did inside the booth. This did not involve surgical changes as in the previous section, but rather non-surgical changes to one's physical appearance.



Figure 7. Augmented glasses sketch by Ren.



Figure 8. Augmented mirror sketch by participant.

In addition to changes to one's own appearance, augmented technology could also change people's experiences with others. Being able to view one's world differently than the world they experience on a day-to-day basis was an idea brought forward by Coe. Manifesting this philosophy into technology design, they stated,

I had an idea of these glasses you put on that like, I wrote, 'I can finally see myself as I see myself, I can not see fucked up forces that society forces me to see, I am who I am forever and that may change in the next minute.' So thinking about, what if you had glasses where you can see yourself in society as you would like to see yourself in society and you couldn't see transphobia, you couldn't see transmisogyny or any other ism.

The augmented world could show other people smiling more (rather than the negative reactions trans people often receive from strangers), make the landscape brighter or darker, and other modifications. Although technology cannot solve issues of transphobia, the sentiment of wearing a pair of glasses that could temporarily rid oneself of an experience that inflicts harm or violence onto them resonated with many participants.

Technologies for Safety

A primary challenge participants mentioned during the design sessions was their concern for safety. They expressed concerns around being “outed” as trans, people using their “dead” names (their prior name associated with their birth gender), and being misgendered in public spaces, as well as fears of violence. Avalon expressed developing agoraphobia in response to these challenges:

I also do feel that my own experience of coming out turned me into a bit of an agoraphobe. I don't really leave the house unless I'm either accompanied by somebody else or I'm going to a spot where I'm very familiar and very well-known among everybody who's there.

Others described compromising in certain environments, and thus losing the ability to express their genders. Some participants mentioned feeling unsafe due to the horrific frequency with which trans people of color are murdered and face police brutality. In light of these challenges, participants ideated and sketched several solutions that would help address trans people's safety.

Safety application. Participants envisioned a community-based technological application involving, in Jace's words, “some type of hotline or device” that enables “guardian angels to be alerted when violence occurs,” (see Figure 9) which is in line with previous research [58]. This technology would also “confirm an appropriate or effective justice is done... that actually holds police accountable” for violent acts against trans people. Participants also envisioned that the app would hold accountable citizens who are violent towards trans people, but would promote alternative justice methods rather than sending these people to prison. In this way, the app would not be linked to the prison industrial complex, and would instead be a community-driven technology to conduct “individual and community accountability plans/actions for perp and survivor and community members” (Jace). Such a technology seems

difficult to design and implement, and participants did not provide details on how such an app would be constructed. It is important to consider how technology design can help communities work towards goals like accountability and justice, and this is an area that can be considered further in future work.

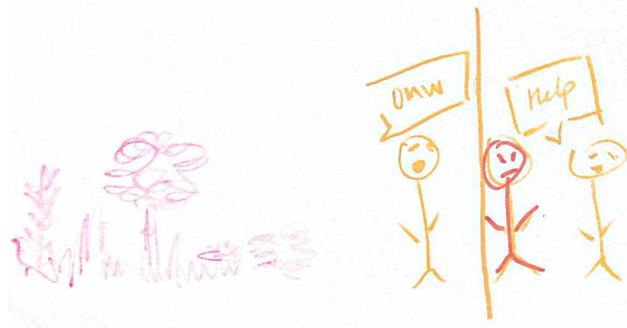


Figure 9. Safety application sketch by participant.

Buddy-finding technology. Another safety application participants conceptualized was a buddy system. The app would assist community members in finding someone who is also trans that can join them when navigating certain areas, for example, “finding someone who is trans who can walk with you late at night or anytime” (Hollace). Such an app could enable people to find “buddies” to accompany them when shopping, to group outings, and to community and skill-building opportunities. Participants also considered that such an app could provide links to help buddies find trans-owned and trans-friendly businesses, as well as “safety houses/spaces that community members dedicate to providing havens from violence. The community spaces [could] host relationship skills workshops, navigate inner-community disputes, and help create stronger communities to combat outer-community violence” (Hollace). While this technology would help trans people to find safety from violence, it is also in part about navigating access to resources, an area we turn to next.

Technologies for Finding Resources

Participants frequently expressed a need for technologies that consolidated resources. For example, many participants expressed difficulty finding reviews or ratings of medical professionals' proficiencies with trans populations. Interestingly, many of the resource-finding technologies participants described and sketched resembled technologies that already exist in the world – yet trans people are looking for technologies designed specifically for trans people and centering trans needs (again surfacing community-based design elements). In addition to the ideas described below, participants also discussed similar social technologies such as a “Craigslist for queer people,” a site to enable online information sharing between trans people with similar identities, a trans-specific dating app, and a trans-specific rideshare app.

“Trans Yelp.” To address the challenge of finding resources, several different groups of participants designed a “Trans Yelp.” Such a site/app would offer an online space for trans people to rate and review local businesses, as a way to collect and dis-

seminate community-based knowledge. Additionally, it would enable trans people to find information regarding trans friendly bathrooms (e.g., single-stall, all gender restrooms, men’s restrooms that distributed menstrual pads), affordable housing, healthcare assistance, affordable food, and food pantries within food deserts. Participants envisioned the Trans Yelp as also including a print version for those in the community who do not have Internet access. Because this idea was raised by multiple groups of participants, we saw several variations. Some were map-based while others were categorically or review based, and they addressed different specific needs. One group sketched a Trans Yelp focusing solely on healthcare resources and finding trans-friendly and trans-competent doctors (see Figure 10) (similar to MyTransHealth [43]). Another drafted a Trans Yelp that centered Black trans people called BTF, and even gave it a URL (blacktransfolk.org/forum) (see Figure 11). In considering this design, Ronan asked several questions related to the site’s filtering processes:

Are they specifically queer spaces? I also added a potential filter, down to are they friendly to queer/trans people of color, specifically? And on there, you could have resources about why you need queer spaces, why you need spaces specifically for queer people of color.

Ronan’s design and questions bring up the need to center intersectional trans experiences, because trans people of color face different challenges than white trans people.

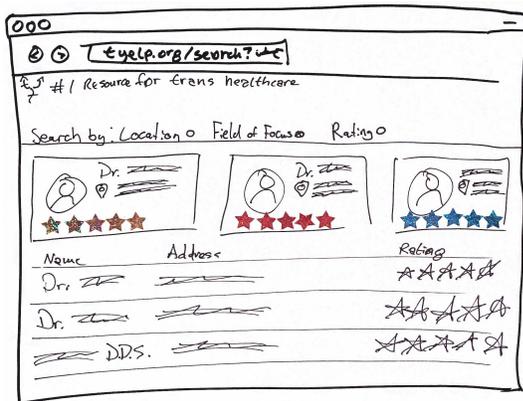


Figure 10. Health-focused “Trans Yelp” sketch by participant.

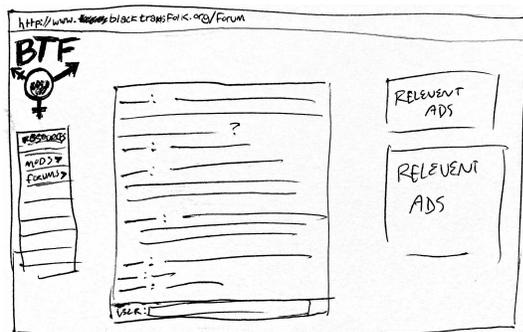


Figure 11. Black-centered “Trans Yelp” sketch by participant.

Trans search engine. Another participant suggested the need for a search engine specifically for trans people to use to access resources that could help them address challenges, such as housing discrimination. In Coe’s words, this would be

a panel where you can plug in your specific issue and recommendations pop up. So like Indeed, which you can hire an organization or persons for what you need. If I needed someone to help with a housing dispute I can go in and type in ‘housing help’ and lawyers will pop up, and also say instructions for community members who will offer their homes for some nights... It would help with access to lawyers, but also have trainings for femmes led by femmes.

Such a technology would deliver resources and center information particularly relevant to trans people, which would be more valuable to trans people than, for example, adding the word “trans” to a Google search.

Trans art marketplace. Another group of participants sketched a social technology for trans artists to share their art and find resources to sell their work. Tyree described this as

a place to showcase all sorts of art and content across the globe. Proper authentic authorship and use of content, for example, a platform where trans folks can share and create relatable content and not be capitalized and overrun with ads. This also abides by safe and inclusive community guidelines.

Tyree elaborated on the site’s economic model, which would “provide monetary support to creators of the art work. Once a post gets X amount of views/shares they get paid X amount of money.” Designing trans technologies requires implementing an economic model that benefits trans people [31], a concern that this design took seriously.

DISCUSSION

We centered trans people in the technology design process, and this enabled inclusive technology design with a substantial focus on sharing community resources and making connections between community members. Many of the designs described above, whether traditional sites or apps, wearable technology, physical technology, augmented reality, or futuristic form-altering technologies, included community-based aspects in serious ways. For example, the body sharing technology involved sharing with other community members, the technologies for safety involved community members as sources of support and accountability, and technologies for finding resources involved learning from and contributing knowledge to other community members. This signifies that trans technology design must reach beyond design for individuals to design for communities and consider how community members can use technology to support each other. Designing community-centered technologies with trans people may serve as a critique to neoliberal discourses that position trans visibility and assimilation as primary goals [17].

Designing with trans people to address trans challenges is a social justice issue. We align with Dombrowski et al.’s [20]

approach that positions HCI as “not just about technological possibility, but also about political responsibility.” Designing trans technologies requires practicing what Dombrowski et al. [20] call *social justice-oriented interaction design* by designing with marginalized people’s experiences of systemic oppression at the forefront, while taking ethics, responsibility, and accountability seriously. Our approach primarily involved the social justice design dimension of *recognition* [20] by working with marginalized individuals to identify salient oppressive societal factors and ways technology design may help to address these. Future steps in this research, which involve long-term relationships with communities and commitment to addressing societal issues, will engage more fully with [20]’s social justice design strategies.

Additionally, questioning the form factor of trans technologies is critical to challenging design assumptions, such as limiting design to websites and mobile apps. Some of the technology forms participants envisioned – such as physical technologies and form-altering technologies – are exciting areas for further trans design work. By involving trans people in the design process and asking how technology can be designed to support this population’s needs and challenges, we enable unique points of view to permeate design processes, which is reflected in the variety of form factors participants included in their designs.

Our findings may be applicable to a broader group of people who face challenges similar to those faced by trans people. Many of the challenges participants identified and designed to address are faced by other marginalized populations (e.g., disadvantaged job seekers’ lack of resources [18], sex workers’ need for safety [61]). Trans-specific aspects of the technologies could be shifted to suit other contexts. For instance, body sharing technologies could be helpful for people donating kidneys to others, and healthcare technologies that give more agency to patients (similar to the “body-changing laboratory”) would be helpful to people facing a broad set of health conditions. Because many participants in our study were Black and/or of other marginalized races/ethnicities, we cannot separate racial inequities from our findings. Race figured prominently in participants’ design ideations. Thus, when we describe *trans technologies* and how to design them, this means intersectional trans technologies that also center marginalized races, ethnicities, and additional salient identity facets. For this reason, technologies designed by trans people of color are likely also useful for some communities of color including people of all genders. The community-based aspect of many of the designs would be helpful to many marginalized communities, trans or not. Community-based HCI research [19] and community informatics [13] have addressed ways communities can support each other via technology. Community-centric results similar to ours have been found in the context of LGBTQ+ youth living with HIV, with whom technologies developed during participatory design processes included camaraderie as a means of social support [42].

Technology can help to provide space and support that enable people to change appearances and bodies, express gender, maintain safety, share resources, and connect with other

community members. Technology cannot *solve* the pernicious challenges trans people and communities face, but can in some important ways improve trans people’s lives.

Future Work and Limitations

We have gathered a set of important ideas and sketches, with which we will continue the human-centered design process. Our next step is to create digital prototypes of some of these technologies, and then bring those back to participants to gather feedback and iterate on the designs. Participants were enthusiastic about being involved in future design sessions and continuing to design collaboratively with us. While some designs described in this paper are not physically and technologically possible to build, others can be built in the near future and can begin to address some of the challenges trans people and communities face. We encourage researchers to conduct future studies to understand how the technologies participants designed in a trans context in this study may apply to other communities and groups of people, and what types of technologies other groups would envision.

While our sample was racially diverse, we acknowledge that more than half of participants were white and had some higher education, and all were younger than 35. This is a limitation, as it excludes some community members with different racial, socioeconomic, and educational backgrounds, and excludes middle-aged and older adults. With a more diverse sample, a better understanding of what different community members need could lead to more inclusive designs.

CONCLUSION

We conducted participatory design sessions to understand and design for the challenges trans people and communities face. Participants envisioned a number of innovative technological solutions in many form factors, such as a body-changing laboratory, a buddy-finding application, technologies to improve safety, and augmented mirrors and glasses that shift how a person views their own physical appearance. These technologies fell into four categories: technologies for changing bodies, technologies for changing appearances / gender expressions, technologies for safety, and technologies for finding resources. Many of these technologies looked beyond individual solutions to involve other community members, signaling a need to focus on community when designing for trans populations. We advocate for a community-based intersectional approach to designing trans technologies to impact positive change for trans people.

ACKNOWLEDGMENTS

We thank the participants in this study for sharing their experiences and designing with us, and colleagues at UMSI and anonymous reviewers for their thoughtful comments that improved this work. Thanks to the Institute for Research on Women and Gender (IRWG) at University of Michigan for funding this research, and the UMSI REMS and UM UROP programs for providing student support. Thanks to MSB for last-minute formatting help.

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