

Speaking from Experience: Trans/Non-Binary Requirements for Voice-Activated AI

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Voice-Activated Artificial Intelligence (VAI) is increasingly ubiquitous, whether appearing as context-specific conversational assistants or more personalised and generalised personal assistants such as Alexa or Siri. CSCW and other researchers have regularly studied the (positive and negative) social consequences of their design and deployment. One particular focus has been questions of gender, and the implications that the (often-feminine) gendering of VAIs has for societal norms and user experiences. Studies into this have largely elided transgender (trans) existences; the few exceptions to this operate largely from an external and predetermined idea of trans and/or non-binary user needs, centered on representation. In this study, we undertook a series of qualitative interviews with trans and/or non-binary users of VAIs to explore their experiences and needs. Our results show that these needs are far more than simply improvements to representation, and that users raise substantial concerns around the underlying framing of gender by even well-intentioned developers, the privacy and safety implications of ubiquitous VAI, and the motivations of the vast for-profit companies that deploy much of this technology. We provide both immediate recommendations for designers and researchers seeking to create trans-inclusive VAIs, and wider, critical proposals for how we as researchers go about assessing technological systems and appropriate points of intervention.

CCS Concepts: • **Human-centered computing** → *Empirical studies in HCI; Natural language interfaces; Sound-based input / output*; • **Social and professional topics** → **Gender**; • **Computing methodologies** → **Artificial intelligence**.

Additional Key Words and Phrases: virtual personal assistants, transgender, non-binary, conversational agents, artificial intelligence, gender

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1 INTRODUCTION

As artificial intelligence (AI) systems become more ubiquitous within society, social computing and cooperative work researchers increasingly undertake investigations into their social roles, potentials and impacts. One thread of this work inquires into “voice-activated AI” (VAI), including virtual personal assistants (VPAs) such as Alexa, Siri and, Google Assistant, conversational agents, and other systems that use natural language processing to directly interact with users through the

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medium of voice [36, 54].¹ Precisely because of this conversational aspect, they are particularly interesting to researchers investigating cooperation and collaboration.

In parallel, gender and other aspects of identity are regularly attended to by researchers, seeking to understand not only demographic disparities in the design of technologies, but how technologies are imbued with and replicate particular views of identity [10, 57]. In the case of VAI, this research extensively documents the feminised nature of these systems, both in the work that is assigned to them and the presentation of these systems, which frequently feature stereotypically-female voices [71, 73]. Researchers highlight the risks this poses for further legitimising and normalising gendered disparities. In at least one case, they engaged in the development of “gender-neutral” voices, both to minimise this legitimisation and to provide more representative system designs for trans and/or non-binary² users whose genders and voices may not be aligned in a stereotypical binary fashion.

Voices are important components of interaction to many trans people. Precisely because of how deeply gendered different styles of speaking and ranges of pitch are, an incongruence in voice can serve as an internal source of pain for a trans and/or non-binary person’s sense of self. Voice can also—in interactions with others—serve as a way in which trans people are identified *as* trans, frequently leading to discrimination and violence [33]. Given the primacy of voice, then, the development of a wider range of voices—including those intended to be “gender-neutral”—is certainly useful. But the degree to which this represents the primary concern of trans and/or non-binary users is unknown. With this paper, we seek to move beyond assuming trans needs and the unquestioned benefits of representation.

We instead assess how trans people experience these systems in practice. Conducting a series of interviews of trans and/or non-binary users, we find that user needs are far more complex than simply a desire for a wider range of VAI voices. In particular, users raise wider concerns about the gendering of VAIs—and the assumptions about trans and/or non-binary identities and experiences built into the framing of a “gender neutral voice”. Further, users’ needs and perceptions are strongly informed by wider concerns about the purposes for which these technologies are deployed, and the structural power of their developers. Their worries include issues regarding surveillance, monetisation, and “pinkwashing”—(which may also be referred to as “pink capitalism”, and “rainbow capitalism”) the promotion of putatively-queer and/or trans-friendly policies or features to reduce concerns about a product or organisation, without substantively addressing the reasons for those concerns.

We expand on existing work about trans experiences of trust and safety with technology, particularly that of Alex A. Ahmed and Morgan Klaus Scheuerman [2, 58]. In this paper, we complicate the idea of representation as a contextless benefit, and propose new approaches that technologists can take in efforts to develop more just VAIs and mitigate harmful implications for identity.

2 BACKGROUND

2.1 Voice and Artificial Intelligence

A wide range of researchers and organisations work to develop artificial intelligence systems that understand and utilise human language through the medium of voice, or Voice-Activated AI (VAI). Prominent examples of the resulting products include Virtual Personal Assistants (VPAs) such as

¹For the sake of consistency, and because our work applies to VAIs overall, we use “VAI” uniformly throughout this paper to refer to both VPAs and other voice-based AI.

²Transgender (or trans) refers to a person whose gender identity is different from the one they were assigned at birth [58]. Trans people may fall within a binary gender (woman or man), or fall outside of these categories (generally “non-binary”) [29]. We use an “and/or” framing in line with existing works in the discipline, reflecting that individual non-binary people may or may not identify as trans [17].

Amazon's Alexa, Apple's Siri, Google Assistant, and Microsoft's Cortana [32]. Less prominent, but just as ubiquitous, are conversational agents or "chatbots"—domain-constrained expert systems used for everything from smoothing team collaborations to customer support. The estimated number of VAIs used globally in 2019 is 3.25 billion with a forecasted growth of 8 billion by 2023 [44].

Although there are significant technical challenges to accomplish natural Language processing (NLP) capable of engaging in dialogue that is not limited to a single task or topic (Allen et al., 2001), literature suggests an increasing investment by industry and academia in developing VAI capable of engaging in dynamic conversations [32, 51]. Conversational design has achieved interactive and collaborative dialogues with humans [4] that are time restricted and focused on completing concrete tasks [32]. Microsoft's 2019 Voice Report forecasts the transition of VAIs from delivering task oriented functions onto fully integrated assistants [51].

VAIs are an important monetisable investment for platform companies, app developers, software integrators, and device vendors [47], with platform companies describing brand integrations for retailers as crucial sales and marketing tools needed to maintain relevance [51]. This technology serves as a business to consumer (B2C) platform that enables companies to embed themselves in increasingly intimate use cases such as hands free control over appliances, enhanced daily productivity, and access to knowledge [51]. In congruence with greater trends in AI, although VAIs have yet to surpass significant "bottlenecks to computerization" [21], they are understood as increasingly relevant technologies.

NLP is often seen as the technical domain in which VAIs originate [4, 16]. Yet, social computing and human-computer interaction researchers—in line with the increasing ubiquity of VAIs, discussed above—engage substantively with questions of how these systems are designed and deployed, and the resulting possibilities for collaboration that are created or constrained. Within CSCW, researchers have prototyped novel systems [42], explored users' perceptions of and practices with existing VAIs [41, 55, 56], and sought to bring researchers together in multiple workshops and panels to discuss the possibilities of these systems [36, 54]. This interest in VAI has grown to encompass other social computing-overlapping disciplines and venues, such as human-computer interaction more broadly [9, 14, 45], ubiquitous computing, and information science [38].

2.2 Gender and VAI

One line of inquiry into VAIs, as mentioned, questions ways in which these systems might constrain users, as well as enabling them, with some justified suspicion about who precisely is represented and treated as central in systems' designs. A particular focus includes questions of gender. Indeed, Cambre & Kulkarni examine how user expectations and experiences of interactions with VAIs are informed, for better or for worse, by the gendering of the device's voice, as a vital open question in VAI research [11]. The interest in this question is in part driven by the way that VAIs are seen as assistive devices, oriented around removing unwanted work from view and user concern, and the long gendered history of what labour is discounted or identified as "menial" [73].

But it is also driven by extensive research indicating that gendering, and gender stereotyping, are already a feature in VAI design. Studies report the aggravation of gender stereotypes through voice activated AI [26, 71]. There is a particular focus on the way that VAIs' default personalities frequently represent "females by name and sound of voice" and serve as socialisation tools that reinforce cultural norms of gendered inequality [71]. West *et al.* highlight how developers—justifying their choice by pointing to users' preference for female voices—produce VAIs with a stereotypically female embodiment. Coupled with the limitations and uses of the technology, this associates women with positions of servitude and mistake making, avoidant or positive responses to sexual harassment, the reference of complex answers to higher authorities, and differences in behaviour towards perceived male and female users [71].

A number of researchers considered gender inequities in VAI in depth. Hannon, for example, discusses how VAIs replicate gender inequality by adhering to female speech patterns and those of people with lower statuses in relationships. With examples such as utilising “I” pronouns and taking responsibility for miscommunications (i.e. “I didn’t understand the question that I heard.” As opposed to “I didn’t understand your question.”), they illustrate how VAI design implicitly connects female AI personas with lower status [26]. Woods describes these female portrayals as being elaborate, stating that VAIs enactment of traditional domesticity (i.e. homemaking, care taking, and administrative tasks) is purposed to ease users’ anxieties regarding their use of VAIs. It increases their intimacy of use, thereby augmenting the reach of surveillance by developers [73]. This resonates strongly with wider work on gender in HCI, which frequently demonstrates the ways in which technological designs not only produce gendered inequalities, but shape users’ own expectations of gender [15, 62].

Another resonance is that very little of this literature has anything to say about trans and/or non-binary experiences with these systems. While there are inquiries into and concerns about gender in VAI, these often treat their populations of interest as implicitly *cisgender*—as opposed to *transgender*. Some studies note the existence of trans and non-binary people either by stressing the need for conversational design that encompasses gender neutral language [26], discussing how male and female voice options reinforce the concept of a gender binary [5], or suggesting the exploration of genderless voice options [71].

Research on the possible consequences of this approach is scarce. Certainly, it may represent an improvement for trans and/or non-binary people. But design approaches could also undermine this possibility by upholding *cisnormative*³ standards: by erasing trans experiences, and treating trans lives as a problem to “fit” to cisgender expectations and norms [37]. This parallels the treatment of gender in social computing which—until relatively recently—has been largely inattentive to trans issues, even in scholarship which describes itself as explicitly feminist and active in critically understanding and challenging the forms that gender takes. Such a gap is particularly worrisome in the case of VAI due to the importance of voice to social interaction, and the impact of (ubiquitous, standardised) technologies in reinforcing cultural norms [7, 64, 68].

2.3 The Politics of Inclusion

One effort to resolve these concerns is, as mentioned, the idea of gender neutral VAI, which aims to operate “outside the binary” of gender. But rather than resolving concerns about gendering, such approaches instead highlight the difficulty and complexity of achieving “inclusive” design. Particularly, in the case of queer and/or trans lives and identities that are frequently defined and understood in intentionally fluid, flexible and contradictory fashions.

The canonical example of such a VAI is “Q”. Billed as the “world’s first nonbinary voice for technology”, Q is pitched as providing greater and more neutral representation within the design of VAI systems [12]. Commissioned by Vice and Virtue, a for-profit spinoff of the media company Vice, the process of designing Q consisted of (in the words of one of the design team):

“To develop Q, the workgroup first recorded the voices of six people who identify as male, female, transgender, or nonbinary to authentically blend a voice that did not typically fit within the male-female binary. To find this voice, engineers worked on the pitch, tone, and the format filter to blend them to agenderless-sounding single voice. Via Copenhagen Pride, the team surveyed more than 4,600 people who were asked to rate versions of these human voices that had been woven into a single

³Cisnormativity refers to practices, attitudes and discursive frameworks which treat cisgender individuals and ways of being as an unquestioned (and, by implication, exclusively “correct”) default [74].

voice. However, at the end of several sound engineered iterations and accompanying user feedback, survey respondents reported preferring a modulated single voice that fit within a frequency range that was perceived as most gender neutral. From this experiment, audio engineers were able to technically define and achieve Q” [12].

The result, the designers hoped, would be “available for everyone to access...we’re working hard to get Q implemented as a third gender option in AI products and believe it will be available before 2020” [12].

While in some ways inspiring, Q and its design process raises as many questions as it answers. There is the question of categorisation and classification; the treatment of trans voices as fundamentally not those of men and women (and as representing a monolithic population), the distinction of non-binary participants from trans participants, and an approach to inclusion that consists of amalgamating and smoothing out difference. Further, the treatment of non-binary voices and voices “outside the binary” as quite literally fitting within the average of that binary, and of non-binary voices as a “third gender option”, risks not so much denaturing fixed, categorical ideas of gender as restabilising them in an only slightly-altered form [19].

This tension in the politics of recognition and inclusion is widely considered and discussed in trans studies. The concept of ‘transnormativity’, coined by Evan Vipond [69], emphasises the way in which efforts for “collective” representation of trans lives frequently involves creating a particular imaginary of what it means to be trans—one that silences other and more complex life stories. As Alex Ahmed highlights in her analysis of voice training software [2], this emphasis on normalisation frequently appears in technological systems that seek to address trans lives.

In an effort to move beyond this, it seems urgent that researchers seeking to challenge processes of normalisation and gender stereotyping in VAI design start with the needs and *emic* perspectives of those users cut out of current systems. Rather than, as is often the case, setting out from an assumed form that those users take. Attending to the practices and particulars of trans needs allows us to confront the plurality and materiality of trans and/or non-binary experiences head-on. Or as we framed it in this paper, to develop academic insights that speak from experience. This approach avoids the pitfall of depending on a simplified and constrained representation of trans and/or non-binary communities that, in Sofia Aboim’s words, results in “a misrecognition in disguise” [1]. To explore precisely these concerns in the case of VAI, we decided to undertake a qualitative study of trans and/or non-binary people’s needs, experiences with and expectations of VAI systems.

3 METHODOLOGY

We conducted a series of qualitative, semi-structured interviews with trans and/or non-binary users of VAs to identify their needs and experiences. Due to the status of VPAs as the most widely distributed form of Voice-Activated AI, we focused specifically on users of Siri, Alexa, and Google Assistant. Our research team includes members with both trans and otherwise queer identities, including disabled researchers, split over three continents. Nevertheless, we are—which we note as a substantive limitation given the racialised nature of vulnerability and surveillance—exclusively white. Our approach was informed by grounded theory methods, which encourage researchers to construct new, context specific theories derived from data [72]. Specifically, grounded theory emphasises the need for the progressive and iterative development of a theoretical scheme, alternating repeatedly between analysis and observation in order to ensure that our frame of interpretation is informed by data on the ground, as it were. Such an approach is particularly fitting for our research as we explicitly aim to understand user needs as the basis for a model of trans-competent VAIs, rather than fit those needs to a pre-existing theory of gender and/or technology.

3.1 Participants

Recruitment and interviewing occurred in two rounds, and were both undertaken by the lead author, under ethics approval from [ANONYMISED FOR REVIEW]. Their interview sampling strategy was a combination of purposive [23, 52] and snowball sampling [53]. Participants were unpaid volunteers. During the first round, eight participants were recruited through a call to participation passed through LGBTQ+ community centers in [ANONYMISED FOR REVIEW], along with LGBTQ+ Facebook groups containing 1-11,000 members, based in those two cities.

A second round of recruitment was undertaken during the process of publishing this paper, in response to feedback from reviewers. Recruitment for the second round consisted of asking previous participants for potential participants in their networks, a second call to participation within the previous Facebook groups, and contacting individuals within our networks. Prospective participants were emailed a Participant Information form outlining the purpose and methods of this research, as well as details regarding the processing of personal information. A Consent Form was signed by each participant prior to conducting interviews.

<i>ID</i>	<i>Gender self-description</i>	<i>Ethnicity self-description</i>	<i>Location</i>	<i>VA use</i>
P1	Non-binary	White	London	2 years
P2	Trans, agender, non-binary	White	Rural England	5 years
P3	Binary identified gender-fluid trans woman	White	Seattle	1 year
P4	Binary trans guy	White, Native American	San Francisco	3 years
P5	Non-binary trans woman	White	Seattle	5 years
P6	Non-binary	White	London	2 years
P7	Binary trans woman	Latinx	Seattle	1 year
P8	Non-binary trans woman	White	San Francisco	7 years
P9	Trans non-binary person	Black, British, Nigerian	London	6 years
P10	Trans man, gender fluid	White, Filipino, American	Seattle	2-3 years
P11	Man	Venezuelan	Minneapolis	7 years
P12	Non-binary, trans masculine person	White, Asian	London	3-4 years
P13	Trans masculine, non-binary person	Chinese, British	London	4 years
P14	Trans non-binary person	Black	Seattle	5 years
P15	Trans woman	South Indian	Detroit	2 years

Table 1. Participant data

The two rounds of recruitment yielded a total of fifteen interviews with trans and/or non-binary users of VPAs, all conducted between June of 2019 and September of 2020. Although all participants identified as trans and/or non-binary, this sample population demonstrated a diversity of gender and ethnic identities, as well as geographic locations, illustrated in Table 1. We considered this sample size satisfactory taking into account both the depth of the interviewing process, the minority status of the population in question. At 15 interviews we reached “data saturation”, reflected by the fact that few to no additional insights pertinent to our research question arose [6, 46].

3.2 Interviews and analysis

Semi structured interviews focused on needs and experiences of trans and/or non-binary users of Voice Activated AI were scheduled for 30 to 60 minutes and conducted via online mediums including

Skype and Google Hangouts. The interview guide (Appendix A) was derived from literature including research pertaining to gender and HCI, VAI market reports, and design guidelines for VAI integrations (required for the development of extensions within commercial VAI). It included questions pertaining to participants' gender, their use of VAI, their perception of trans-competency in design, and their trust of VAIs. In order to understand participants' relation to the forecasted development of VAIs, the interview guide included questions addressing participant's reactions to an extract from Microsoft's 2019 Voice Report [51].

Our core research question was: *what are the needs and experiences of trans and/or non-binary users of VAIs?* In line with the iterative developmental strategy of research directions deriving from grounded theory methods advocate, this research question iteratively developed to include components as diverse as trans representation, gender-affirming and trans-specific design, as well as concerns within VAI systems, as described below (see Section 4).

Interviews were transcribed and analysed in two rounds using NVivo. The lead author drew from a grounded theory approach, following the coding guidelines of Corbin & Strauss [66], constructing a theoretical scheme grounded on initial, line-by-line identified codes. The analysis process for the first round involved three phases: conducting open coding techniques, developing themes by considering causal and contextual relationships between codes as informed by this study's theoretical frameworks (engaging in axial coding), and conducting selective coding

After conducting the second round of interviews, a second round of transcription and analysis was conducted, adding an additional fourth and fifth coding phases to this analysis. In the fourth phase, the second round of interviews was integrated with the scheme developed in the first round. This began with line to line coding and evolved into selective coding after the second interview. The scheme was adapted and categories reorganised when data called to question existing categories, until there were no additional emerging categories, properties and dimensions pertaining to our research question. This moment reflected the earlier-mentioned data saturation. In a final (fifth) phase, as part of the process of writing this paper, categories (and their exclusive members) were set aside if we determined that they were "[irrelevant to] this specific manuscript" [13, p.298].

4 FINDINGS

Our findings are organised into three main sections, aligned with the themes that we saw in coding and reviewing the transcripts:

- (1) **User experiences of, and feelings about, being represented by VAI systems;**
- (2) **User needs and suggestions for VAI development, and;**
- (3) **Tensions with and concerns about the expanding role of VAIs.**

4.1 Gender Representation

Participants (as detailed in Table 1) uniformly described their gender in ways that exceeded or fell outside the binary. All but one participant who identified in binary terms also articulated that their gender identity and/or presentation transcended gender norms (P4: "I use exclusively he/him pronouns but I do like to incorporate feminity and femme clothing and societally more feminine things like paining my nails and doing my makeup and stuff"). Participants provided rich descriptions of their identity, revealing that some of their genders may transcend any form of categorization (P2: "I'm comfortable with trans, agender, and non-binary, because they all apply at different levels and at different intensities at different times, but trans is the go-to." P8: "I think it's not necessarily that I move through genders but that gender itself isn't fixed and instead...is constantly shifting and evolving").

Thirteen out of fifteen participants were negative about the representativeness of their device's voice persona, and eleven explicitly stated that their VAI was not designed for them. Participants discussed VAIs as being designed to be generic tools (P6, P12), with three explicitly stating that they were not designed for trans and/ or queer people (P4, P5, P15: 'I don't know if queer people were considered when making Siri.'). The opportunity for VAIs to either affirm or invalidate participant's gender does not seem to have emerged at this stage of the technology's development (as noted by 14 participants), with the exception of difficulties in changing users' name within VAI systems (as noted by P10). Two participants evoked VAI design as being undertaken through a dominant cultural frame:

"On a structural level and the scale in which they are defined, there is an inevitability that it is going to be designed on tropes and you know, hegemonic society, that is what it's designed for, it's the hegemony." (P2)

Most (11) participants were directly positive about the idea of a genderless voice option in VAI systems, either for themselves (P1, P5, P6, P9, P10, P12, P14) or for ethical reasons and for other people (P2, P4, P7, P11: "I wouldn't say it's important for me personally but I would like to see that for the rest of my community"). But while genderless voices were frequently desired, the proposal of Q: The Genderless Voice was met with critiques (P7, P9, P10, P11, P12, P13, P14, P15) regarding its adequacy in representing trans and/or non-binary people.

Participants pushed back against the idea that gender should be treated as equivalent to "where your voice falls within a stereotypical range of pitch" (P7). P11, for example, stated: "The problem is not the voice itself. The problem is that people think that voice means a gender." P13 stated: "There is no genderless voice because there is no gendered voice". Participants proposed alternative forms of representation, all which centred flexibility in design (P13: "you'll never find one voice fits all kind of character"). Proposals included providing a wide spectrum of un-gendered voice options (P11, P14), and having VAIs mimic users' voices (P13).

Even when addressed in a competent manner, representation was not always seen as important by participants. Some did not see this subject as relevant to them (P14, P3), others expressed concerns with representation within these systems (P6, P8, P11, P12, P14, P15), and five explicitly viewed other changes within VAI systems as more pressing than representation (P1, P3, P13, P14, P9: "It's just another voice, you know, it's just the voice, another like function on the same system").

4.2 User Needs

The second theme concerned user needs beyond representation in vocal patterns—specifically, suggestions for new features in VAIs that would be gender affirming and/or more generally helpful for trans and/or non-binary users. This included wider support for queer and/ or trans-specific language and terms of art, integration with trans healthcare needs, and contextualising users to queer and/or trans community dynamics or safety concerns in new spaces. Of specific concern to VAI technology, participants discussed their desire for a device that serves as a companion.

Participants demonstrated being unsure of their wishlist or reluctant to increase their usage but did identify user needs beyond VAI incorporating a genderless voice. They expressed a desire for the enhancement of current functionalities such as organisational tools (P11, P12, P14, P15), platform connections (P6), voice control (P6), and music services (P2, P4, P5). One participant noted functionalities that enable their leisure time (P2) and two mentioned a conversational agent that meets their need for social interaction (P7, P15). Gender affirmation was noted as a requirement by 11 participants in the event that VAIs develop in ways where interactions intersect with users' gender (P7: I don't feel like it comes up when I use my voice assistant. I mean, I think that when and if we transition more to conversational AI then I think that that would be absolutely a

requirement”). When asked if they would want developers to better understand their gender in order to provide more competent services, seven participants responded positively. Four provided suggestions for trans-specific purposes that voice AI could be geared towards. Some of this centred on the recognition of queer and/or trans-specific language or context, as illustrated by P6:

So I guess understanding what the words that we use mean. Like if you say, ‘hey can you find a local binder company’ understanding that the person means a chest binder rather than a stationary company. I guess use of language would probably be the biggest thing.” (P6)

Understanding trans contexts would extend beyond language recognition and encompass sensibilities to nuance, such as how each specific user discloses their trans identity in different contexts. This understanding would be required for services that successfully connect users to queer and/or trans related products and content (as suggested by P2 and P4), for VAIs that support trans-specific healthcare (suggested by P3, P5, P10 and P15), and ones that serve as conversational companions (suggested by P7 and P15). Healthcare VAIs, for example, would have to recognise requests such as “refill my HRT” (P5, referring to hormone replacement therapy, a common part of medical transitions) and handle other queer and/or trans-specific language or contextual meanings. As illustrated by P3: “Knowing what my gender is, is something that my doctor would need to know as well, who I’m out to, to provide proper treatment”.

Participants also suggested features that supported their safety and familiarising queer and/or trans users with new contexts, cities or spaces when visiting—highlighting local community centers or events (P6), or, inversely, highlighting unsafe spaces, flagging areas known to be sites of danger for queer and/or trans people:

Like if Siri had some sort of advanced algorithm that could go through like yelp reviews of some restaurant I’m trying to go to and points out that there’s some sort of ‘maybe don’t go here because it looks like these folks don’t...’ you know what I mean? Like a safe space algorithm that looks for bad reviews on google reviews or whatever.” (P5)

The development of such a feature—which would require careful attention to precisely the concerns about surveillance and data extraction discussed elsewhere—highlights a pressing issue for trans people: concerns and tensions about safety. These were discussed in their day-to-day lives and also made themselves known in how users evaluated the desirability of VAIs in practice, as we discuss in the next section.

4.3 Tensions

There were various desires for feature changes, which surfaced distinct concerns about VAIs. The interviewees responses to questions regarding current and forecasted iterations of VAIs revealed ambivalent and uneasy attitudes towards adopting these devices to their full technological capacity. Their worries were captured in a number of expressed tensions between the convenience of use and the dangers of VAI for trans communities. In this section, we introduce four tensions as they arose: corporate profiling and data collection, distrust in developer communities, safety concerns related to trans visibility, and their associated design requirements.

Participants were not convinced that the functionality offered by VAIs outweighs the risks involved. Understanding how trans identities impact user uptake provides intimate detail into the personal considerations shaping technology use, especially when it is designed without taking into account the specific needs of minority communities. Nine participants expressed no desire to adopt future functionalities within VAIs as forecasted in Microsoft’s 2019 Voice Report [51]. P1, for example, responded to descriptions such as “In time, digital assistants will play a more proactive

role in our lives, automatically scheduling a repair on a broken water heater or suggesting tickets as soon as our favourite band releases tour dates or reordering household items which are running low” by stating:

“On the one hand it seems like it could be very very useful. On the other it seems like it could be a bit creepy and I’m very concerned about data usage and profiling.” (P1)

All fifteen participants voiced these concerns about their devices, they were worried about who had access to their data and what companies did with that information. The most widespread concern (discussed by thirteen participants) was the collection and use of data through VAIs. Eight participants reported not knowing when or if their VAI is listening (P2, P3, P5, P6, P7, P9, P13, P15), four expressed a feeling of invasiveness (P1, P12, P13, P14) and nine expressed feeling a lack of transparency with what is done with their data (P1, P3, P4, P6, P7, P9, P10, P11, P12). Participants expressed concerns about who may access their data, with three pointing at data being sold (P13, P14, P15).

“Why would I want someone to know about me? I don’t know about them. Unless, like, I’m telling them things about me. I don’t know if like, if it’s, if I want them to know then they will know. But I don’t want them to just like, know things about me.” (P9)

Participants also spoke to concerns about being emotionally vulnerable in their interactions with their devices, due to fears of increased corporate manipulation (P12, P14). This was illustrated by P12:

“If it’s one person or one bot, that you have a relationship where throughout the day, it’s a lot harder to potentially ignore them...I feel there’s a lot of layers of like corporate emotional manipulation that could really, really play into this...I think, if something followed me around all day, I’d be wary of not only encroaching on my privacy, but also my behaviour like, would that change how I relate to everything around me?” (P12)

Directly related was their mistrust of developer communities. All of our participants expressed feeling distrustful of VAI developers. Participants did not trust developers’ ethics (P2, P7, P13), business purposes (P5, P12, P13), biases (P3, P6), treatment of workers (P9, P12, P15: “A lot of services that pretend they have AI. And really, they have human beings doing things for very cheaply”), and the wider structures of power and ideologies that VAIs are built within (P1, P2, P15), mentioning capitalism, patriarchy and white privilege as factors embedded in these systems. As P2 stated:

“[VAIs] replicate systems like capitalism and things like that, that they are build to exist within. The learning that they do as part of the AI process is going to be learnt towards hegemony which is not what we need to do. There’s a risk of intensification of those things.” (P2)

Participants pointed to varying concerns with trans people being visible to developers. These included: an increased vulnerability to corporate manipulation (P5, P8, P12), the notion of being surveilled (P15), concerns with personal repercussions (P13: I am concerned that that information could go out and potentially affects my most future in any extent, whether it’s professional or personal), the aggravation of outing and targeting trans people (P1, P5), the possibility of developers “doing something really problematic (P3), a general feeling of invasiveness (P8, P12), and simply not deeming it necessary (P9, P13). Greater competency of users in general was described by P14 as a breach of their safe spaces, where their vulnerability is leveraged for external gain:

“It doesn’t necessarily feel safe...[you’re] creating this community, safety and community in order to express yourself...your phone is such an intimate thing, but...the creators can come in and buy your information, buy that vulnerability, buy the thing I was able to produce in safety, in community.” (P14)

Although most (11) participants noted gender competency as a need in increased conversational capacities, only 7 participants were willing to provide more detailed data about their identity in order for developers to enhance VAIs’ understanding of their gender. Some of these participants also noted a sense of unease with their decision (P3: “Yes, and that will probably bite me in the rear at some point...I don’t trust a lot of cis people to be honest”). Distrust in VAI developers’ ability to adequately understand or represent the needs of trans people, directly influenced the experience of these individuals with technology. Their concerns spanned broader than development communities, however. Participants mentioned fears of third parties, including those wanting to harm trans people (P5), as potential entities that could access users’ personal information (P1, P5, P15: “Doxxing is easier than it’s ever been before”).

Groups described as a direct threat to trans people included white supremacist organisations (P14), gender critical feminists (P13), and law enforcement (P15). Four participants expressed concerns with developers sharing data with the state and/or law enforcement (P1, P7, P10, P15), and five explicitly expressed not trusting these institutions or individuals within them (P1, P5, P7, P10, P15). Three participants expressed concerns with disclosing their political ideologies to developers (P1, P5, P10). Participants’ concerns with the relationship between developers and the state are best illustrated by P15:

“I don’t think that’s the case necessarily that like law enforcement can do whatever they want, you know, with full access to everything that they will notice or whatever. But I do think the nature of which subpoena power and the nature of the kind of collaborative relationships, it makes it not hard for law enforcement to have access to these sorts of things” P15 also stated: *“I’m not worried about being arrested for being, I’m worried that in the event that I am arrested, it will be worse.”* (P15)

These worries were aggravated by the fact that many participants belong to marginalised identities other than being trans and/or non-binary. Design embedded with oppressive ideologies pertaining to race and class was thus perceived as a concern. Their specific positions as individuals pertaining to a gender based marginalised identity, however, explain why design that fails to include trans-inclusive notions of gender presents a problem to trans people specifically. This is best illustrated by P13, who makes reference to worries that explicitly transphobic ideologies might be built into the design of technological systems:

“If technology...is ever influenced by... trans-exclusionary feminism... then that’s a real, a real concern for genderqueer people as a whole” (P13)

Such a fear is hardly hypothetical: most prominently, the women-only social networking platform “Giggle” deploys gendered facial recognition to screen users, knowingly (and to some degree, intentionally) discriminating against trans women [59].

Concerns with corporate influence pertaining to mainstream attitudes towards trans people were also discussed. Two participants feared that the misuse of data and the ideology embedded within the design of technology may exacerbate mainstream hostility towards trans people (P13, P14: “The fact that the false information that’s being circulated is like, putting my livelihood and people that are like, like me, life in jeopardy like, that is the severity of it is just like, it’s scary. It’s, you know, it’s, it’s terrifying”). Along with P15’s description of the current political climate as one that is descending into fascism (P15), these concerns may be seen as potential threats to trans people’s safety.

Safety was clearly crucial tension reflected in our data. It pervades all interviews. All participants articulated a lack of mainstream support and understanding regarding their gender. P1, for example, stated that lack of understanding and support is “pretty much everywhere except for a few spaces”. Echoing Scheuermen et al.’s findings [56], the majority of spaces they engaged in were described as including individuals demonstrating resistance and a lack of acceptance of trans issues (P3, P10), and/or not being aware of the meaning(s) of identities such as non-binary. They often lacked insights into the intricacies that may characterised different people’s gender (P31, P2, P8, P10, P15, P13, P14, P12: “Even when people understand being non-binary, they don’t always understand that you might also be trans masc at the same time, it doesn’t mean being completely neutral, 50/50, or nothing kind of thing”). Participants’ attitudes towards VAI use may be explained by the fact that they all described living with varying levels of safety concerns.

Some participants described consequences to being visible as trans in mainstream spaces (P11, P14, P15), with three discussing the complexity of being able to “pass” as cisgender (P8, P11, P12) as a characteristic that enables people to blend in at the cost of their identity becoming invisible (P11). P14 may best describe this relationship with trans visibility: “I find myself like, in this like, tension of like, I have to be as big as I can, but also like, you know, there are people in this world that like, are actively positioning themselves against my existence.” Although discomfort was described as emotional or psychological, four participants did point to potential threats to their physical safety (P4, P5, P14, P15).

The high level of discomfort regularly experienced by them was highlighted by their characterisations of “safer spaces” that are a minority (P1, P3, P4) and they “have to actively look and find” (P1). Safer spaces were places where they receive equal treatment (P1, P2, P4, P13). Spaces where they are understood and supported in their gender (P2, P10, P13, P14, P15), where correct use of pronouns is a minimum standard (P2, P9) that extends to them “being able to exist” and “treated like a normal person” (P15) without changing some aspect of themselves (P1, P2, P4, P14). Although one participant noted that pronouns were not important to them (P13), they issued this to the lack of importance that they attribute to language, stating that having affirmation of the intricacies of their gender as important to them.

Nine participants described safety as emerging from queer and/or trans people and spaces (P1, P2, P4, P5, P6, P7, P10, P11, P12), which may be attributed to a sense of familiarity with gender variance and trans and/or non-binary people. Four participants described this familiarity as desired and resulting in gender not being treated as the sole category that defines them to other people (P5, P6, P8, P12):

“I’m not the first non-binary person [in this space], so...there’s a lot fewer questions. Whereas a lot of the time, I can be in a big group of people, and I’m probably the only trans person, probably the only non binary person and that becomes something my whole identity.” (P12)

Several participants reported a lack of understanding and support for trans and/or non-binary people, within LGBTQ+ spaces (P1, P6, P7, P9). Two participants, for example, expressed feeling a lack of understanding of their specific relationship to gender even from other trans people, pointing at the need for more than trans representation in order for spaces to feel safe (P10, P15). Taken together, our participants describe safe spaces as places with intentional frameworks that included welcoming multiple marginalised identities (P1, P9, P14), supporting movements such as Black Lives Matter (P14), operating within trans-inclusive notions of gender (P5, P9, P15), and incorporating leftist ideology (P14). These characteristics may promote respectful interactions, with nine participants describing supportive relationships noted as sources of safety (P1, P2, P3,

P4, P5, P6, P10, P12, P14). Yet rarely, did they feel their VAI technologies were optimised for their particular safety needs.

The centrality of communication and community to participants' experiences of both safety and harm speaks to the complex relationship they have with VAIs. These technologies are designed for communication, yet largely constructed outside the spaces and contexts where participants feel their safety and comfort are a priority. In the absence of the grounding of the VAIs in such spaces and contexts, some participants saw representation and trans competency as a threat; something undertaken to lure them into an otherwise exploitative and disempowering situation. This dynamic was especially visible when discussing voice ranges. While a more representative range of voices was generally desired by participants, five (P5, P6, P7, P12, P15) feared that these could be used to increase users' susceptibility to sharing information with companies that profit from trans people without addressing their needs. Additionally, P15 described a wider socio-political danger within VAI representation, comparing it to advertisements featuring trans people by companies that have "enough money to house every trans person that is homeless right now, and they're not going to, and people are going to feel cared for by these affirmations" (P15), and stating:

"I see a danger of representation, distracting for material needs, and making it harder to like form in a unified political front to get things done, right. Like, if tech companies started doing trans representation and all of their apps or or voice things or whatever, how much more willing are trans people going to need to organise against, or even trans developers within tech to organise unions are cooperatives where they like feel cared for by the management of the company? So that's, that's the big reservation is like, the sort of ideological conditioning." (P15)

Given the structural power of corporations such as Google and Apple, and the relative lack of power of queer and/ or trans communities and individuals, some reactions to the idea of a "genderless voice" included the themes evoked by P5:

"I don't think I want it because It will be exploited by big corporations for profit. To profit like people like me who would be more inclined to share their personal information or whatever with a genderless voice. So no. Even though I'm like that feels very comfortable to feel." (P7)

Participants identified a range of design requirements against the backdrop of these tensions. The need for transparency (P4, P6, P10, P11, P12, P14, P15), control over data disclosure and dissemination (P1, P8, P9, P12, P15: "Have agency to like, control my data, or erase my data or do whatever"), for developers to have accountability to users (P14, P15), for stronger law and regulation (P1, P6), and for public accessibility to information about data use (P1) and critical analyses of technology (P15: "So much of our thought around technology is so uncritical and so divorced from conversations about power or about the state or about ideology" were among the most needs identified. P1 stated:

"They are trying to make it as default that you accept everything blindly and it should be the other way around obviously in my opinion. The laws should serve in a way that you automatically opt out unless you explicitly give consent and you're not required to give consent in order to access content." (P1)

One potential solution to tensions regarding VAIs revolved around participatory and community-based development, which was wanted by seven participants. Three participants explicitly stated that queer and/or trans developers would increase their trust (P4, P5, P8). P2 discussed how they imagine having a desired relationship with developers through a VAI device, which would 'enable something that's helpful for people that I know are good people and you know, not Amazon',

similarly, desire to give money to people within the trans community was expressed by two participants (P15, P9). Participants described VAIs developed by queer and/ or trans people as being more authentic (P5, P15), with one discussing that meaningful representation can only occur through giving people power within the design process:

”Putting that power into the hands of marginalised communities kind of gets rid of having to solve the problem to try and find like, a one size fits all...I think that representation, when it’s done without that kind of power, redistribution or power re-balancing isn’t actually good, or meaningful, or helpful” (P15)

One participant didn’t want community developers (P15) and stated that trans developers would not increase their trust (P13: “just because someone is transgender, or genderqueer doesn’t mean that they are understanding an acceptable of me and my life”). Although all participants own and use VAIs and seven explicitly recognised VAIs’ usefulness, two explicitly stated that there are more important issues in the world than further developing VAIs, and even promoting trans inclusion within these devices (P9, P13):

“The main concerns that trans people have, if they had a list, their priority wouldn’t be gender inclusive voice assistant technology, that’s not on there at all. It’s bathrooms, It’s schools, It’s athletes and sporting and rights within those areas at the moment, that’s what’s most relevant and for trans people, as a minority to be more included in any society. Voice assistant technology isn’t at the forefront of that.” (P13)

Similarly, P15 critiqued identity-specific solutions to design and stated that representation would not account for all of their needs. They detailed other factors to consider, including device modification, non-profit motives, user owned cooperative technology, marginalised representation, and agency over data:

“Thinking of needs as specifically identity based kind of reinforces monolithic notions of identity, rather than focusing on like the flexibility to meet as many kinds of needs as possible.” (P15)

“Imagining a world where like, worker, or user owned cooperative tech companies, or apps or whatever exists...those decisions are made democratically, among like, a base of particularly marginalised users, and I know exactly what’s happening with that data and I have agency to control my data, or erase my data or do whatever like, in that, in that magical world where capitalism doesn’t exist, yeah, I probably keep using assistive technology.” (P15)

The concerns highlighted in this section are already present in participants’ engagement with VAIs. Eight explicitly mentioned wanting to limit their comfort with using VAIs, (P4, P5, P6, P7, P8, P10, P12, P14) and one completely stopped using it (P15). Three participants behaved in ways that concerned them (P5, P9, P14) and one, while limiting their use, also expressed wanting functionalities for highly intimate use. P5, for example, stated that they use Siri for “pretty much everything” but later stated “I think it’s also kind of terrifying how dependent I am on my phone”.

This does not mean that relationships with VAIs are non-existent—interestingly, while ten participants mentioned having clear distinctions between their VAIs and humans or not having a personal connection to their device, eight of those ten anthropomorphised their VAIs through the use of personal pronouns—or that stronger relationships with VAIs are not desired in theory. P7, for example, discussed wanting a conversational agent that helps them “exercise that social muscle”. But it does mean that particular attention must be paid to the potential harms that come along with VAIs—harms around privacy, trust, and power—and the ways in which trans users are particularly vulnerable to these harms, which are extensively discussed in the following section.

5 DISCUSSION

This study suggests that trans and/or gender variant users of Voice Assistants currently engage with their devices ambivalently. While all participants are VAI users, they all discussed being mistrustful of their devices and having neutral to negative perceptions of trans affirmation and representation in VAI design. Participants expressed concerns with a potential transition towards trans-competent development, fearing VAIs would deliver affirming and representative user facing designs that otherwise do not consider their needs and experiences.

5.1 The Intricacies of Inclusion

As discussed in our framing of the paper (see [Section 2.3](#)), efforts to include trans and/or non-binary people in the design of VAI systems have—where undertaken—largely focused on adding a specific “genderless” voice to ensure a more representative system interface. For our participants, this was not the highest-priority feature. While they sometimes desired greater representation, its adequacy in representing trans people was highly critiqued and other requirements deemed more important. Several participants expressed mixed feelings about the idea of a system featuring trans representation in voice and gender-affirming conversational design, expressing privacy concerns and a scepticism about developers’ ability to deliver products that otherwise meet their needs.

Two particular aspects require further discussion and consideration when undertaking VAI design. The first is how representation is treated and valued. Implicit in our participants’ understanding of representation is the importance of recognition: a way of affirming the humanity, moral agency and equality of each other—as individuals, and as communities. This approach chafes with our participants’ understanding of how VAI designers approach representation. They worry that designers’ understanding contains only a surface-level approach to trans needs, visible in their focus on developing gender-neutral voices. While well-intentioned, this approach fails to address our participants’ dominant needs and flattens trans representation into, literally, a single voice.

Participants’ concerns resonate strongly with theoretical work around recognition in political philosophy. Scholars such as Nancy Fraser, Axel Honneth and Patchen Markell argue that—while recognition is not a *bad* thing to achieve—there are dangers to making it central to efforts to achieve change:

“Movements organised around demands for recognition may indeed produce concrete gains for members of subordinated groups. Yet in characterising injustice as the misrecognition of identity, and in embracing equal recognition as an ideal, they may simultaneously make it more difficult to comprehend and confront unjust social and political relations at their root. In some cases, even apparently successful exchanges of recognition may reinforce existing injustices, or help to create new ones” [40, p.5]

Multiple participants’ comments serve to ground these concerns about representation-oriented approaches to change. Given the larger economic and political context of surveillance within which VAIs were developed, and seeing their relationship with developers as largely extractive, many worried about how these technologies could amplify the hardships they experience on a daily basis. In particular, they expressed concern about how any services developed specifically for their needs might be used against them. A prominent worry was that recognition would serve to encourage users to engage more intimately with their devices—and so expose them to harms given the power dynamic with developers and motivations of corporations.

This concern was not theoretical, as was emphasised through our earlier discussion of the multifaceted safety challenges trans individuals face in their daily lives. Indeed, the ambiguous or threatening experience of these efforts for recognition strongly mirrors the findings of both Alex A.

Ahmed and Scheuerman *et al.* in their studies of trans voice training software and experiences of online safety, respectively [2, 58].

Simplistic understandings of “the non-binary voice” were also critiqued by participants, who emphasised that even within the trans community, individuals have different needs. These needs may very well be informed by individuals having intersecting identities with other marginalised categories. While VAI systems and their possible features are not comparable in scale to legal or medical infrastructures—at least, in the potential for obvious harm that they may cause—it is clear from our interviews that the implicit centring of representation as a priority makes assumptions about trans people’s needs that are not grounded on user research.

The worry here is then not only that users’ more urgent or substantive needs are ignored, so much as that they are obscured, with researchers and developers treating issues as “solved” after recognition is achieved and so leaving other concerns invisible. As these systems become more ubiquitous and are further developed, a lack of intentional consideration of trans and/ or non-binary users will produce devices that omit their needs—particularly if all of their requirements from VAIs are treated as “fixed” through user-facing design that claims to represent them and affirm their gender identities.

Interlinked with this is our second concern; the implicit cisnormativity, and normalising potential of VAIs with binary genders, and the subsequent risk of proposals to resolve oppression within this design through incorporating a single (fixed) voice deemed non-binary. Participants spoke clearly on this topic: a single fixed voice aimed to represent trans and/ or non-binary people is a reduction of the diversity within this community and perpetuates the notion that specific vocal ranges are linked to specific genders. Standard VAI design omits intentional considerations for trans and/ or non-binary users, acting in accordance with trans-exclusive literature regarding best practices in VAI development, and as P11 described it. Justified by the claim that the ability to identify people’s gender is necessary for individuals to feel safe, Nass & Brave discuss “clarity of gender” as a crucial design requirement [48]. This idea of the fixity of gender as necessary for safety, as Schildt & Westbrook argue, caters to cultural outrages and “gender panics” used to prompt and justify violence against trans people [60].

Validated in media narratives and legitimised by juries, approaches to gender that treat opacity as violating or unsafe lead inexorably to the portrayal of trans people—particularly trans women—as deceptive, excusing and necessitating targeted violence [60, 65], socioeconomic discrimination [63], and health-based disparities [37]. This is further illustrated by largest survey of transgender people in the United States, which in 2015 found that 46% of transgender people had experienced targeted verbal harassment, 47% had been sexually assaulted, and 54% had experienced intimate partner violence [50]. Understanding VAIs as “powerful socialising tools” [71], it is clear that the feminine and highly binarised design of VAI personas is not simply a choice that amplifies gender inequalities for cisgender women. It is also one that normalises and reinforces the frames of gender that underpin the violence and discrimination experienced by trans people at a mass scale.

For those who would seek to resolve this through (as discussed earlier) the inclusion of a prototypical “non-binary” voice, it is important to remain aware of, and avoid reinforcing, ideals about how trans people “are”, and “should be”. Our participants’ critiques of Q or its equivalents, reflect a similar sense of trans/and or non-binary erasure from representation. While they do not verbalise it in such terms, participants’ responses to Q demonstrates that a “clarity of gender” based approach to VAI design that links a vocal range to a gender reduces the diversity within gender variance (even as represented by our sample group) to a single alternative to man or woman. This approach prioritises the comfort of cisgender users by eliding the existence and experiences of trans and/ or non-binary people.

The focus on clarity of gender, emulates mainstream perceptions, portrayals and *expectations* of trans people, as have been presented from 1960s onwards, that reinforce singular, idealised and “transnormative” views [69]. Seven participants explicitly problematised the notion of voice being bound to a gender. Where our participants do largely approve of a more representative range of voices, it is notable that several positioned the idea of representation through a (single, fixed, equidistant) “genderless voice” as useful for others, not for themselves. That is, while it seemed valuable in the abstract, for many participants, it did not map to their personal needs. The “genderless voice” as representative of all trans/and or non-binary people thus retains (and in some ways, reinforces) a limited idea of who and what constitutes this identity group. This carries implications in the representation of non-binary people whose voice does not match the “genderless voice”, and in the potential development of gender-affirming dialogue by VAIs that assume (rather than ask) for users’ pronouns based on their voice range.

Participants mention in particular their constant anticipation of misrecognition and the stress of managing that as an aspect of their daily lives. Especially for those individuals who express a deep reliance on their devices, being confronted with well-meaning but fundamentally misaligned representations may be especially painful. Their concerns are warranted. As Ahmed demonstrates, these norms around who trans people are, are already present within technological systems aimed at trans populations, and are frequently experienced as setting expectations that conflict with users’ identities [3]. This highlights the need for design to be grounded in a range of users’ experiences, rather than assumed experiences. Further, it shows that any solution is less likely to consist of a fixed mapping of gender to voice determined by developers. Likewise, it is more likely to involve a system that assumes a wide and fluid relationship between gender and voice, as illustrated by the possible alternatives to Q proposed by participants (all which centred flexibility)—not only in VAI personas, but in their expectations and treatments of users.

5.2 Structural Power and Design

In articulating their concerns and the resulting reticence about further engaging with VAI systems, participants repeatedly surfaced larger, structural concerns - namely, developer’s motivations and surveillance. While there were trans-specific aspects of these concerns (which we will discuss more in detail in the next section) many are general cautions about the form that VAI systems take—albeit exacerbated by the experience of vulnerability that characterises many trans lives.

Participants demonstrated an immense mistrust of VAI developers, perceiving them to have commercial purposes that overpower ethical considerations. In fact, all participants expressed concerns with VAIs (compared to the 41% rate of concern reported in Microsoft’s Voice Report [51]). These concerns are likely to get worse, not better, absent intervention, due to the increasingly ubiquitous ways in which VAI developers are seeking to involve their technologies in users’ lives. McStay, for example, describes industry investments in voice analytics that incorporate emotional detection based on signals in users’ voices [43]. This is already being explored by Amazon (who have filed a patent to assess users’ voices for health concerns in order to sell them medicine [25]) and, as McStay argues, adds an emotional and affective layer to users’ data profiles. Such an approach enhances and incites the intimacy of user engagement, and thus the intimacy—and quantity—of data collection [43].

These commercial data applications are in direct opposition to our participant’s needs within VAI system. They confirm participants’ perceptions that VAIs serve as tools that enhance developer’s ability to collect data (discussed by thirteen participants) and to manipulate users’ behaviour (as discussed by P12 and P14). It is important to note that these concerns were at times discussed as *fears*. With data handling being designed to be as frictionless as possible, users are not typically

aware of what data is gathered, who it is shared with, and how it is used (as described by nine participants).

The severity of their uncertainty is highlighted by the fact that eight participants did not even know if or when their device is listening to them. Greater transparency regarding this matter is likely to increase participants' reluctance of use: although fourteen participants are current users, nine explicitly stated that they would want to adopt forecasted iterations, many of which pointed to privacy concerns and a feeling of invasiveness. P15, the only participant who has already stopped using VAIs, did so specifically due to concerns with surveillance.

The intuition of participants regarding the general safety issues of VAI is warranted. Privacy concerns are often interlinked with this increase in functionality and ubiquity, since data collection and privacy are often opposed to each other. Contextualised within an environment where participants described only feeling safe within a minority of spaces characterised by specific frameworks, practices, and people that serve as a buffer from mainstream hostility, the threat of privacy breaches, which may be grave for anyone, may be felt in specific and acute ways by trans individuals.

Although VAIs only save and send audio data to the cloud for processing once their "wake word" is detected, they have wrongly recorded users without their awareness [25]; systems log and transmit those conversations they overhear, and (although Google and Apple, at least, have now stopped the practice) some VA developers have human agents manually listen to and process recordings. Developers currently share data, including identifiable data (with users' consent) with third party skills app developers. They have shared user data with government officials in court cases [67], and collaborated with the government in providing healthcare services [25]. None of these entities have been described as "safe" by participants, and in fact some (i.e. state institutions) have been explicitly depicted as untrustworthy and potentially harmful (recalling P15's worries of being identified as trans in the event of being arrested).

The increasing ubiquity of VAIs comes with their likely presence within "safer spaces" for trans people. These devices serve as a window into the 'vulnerable and raw' self expressions (as described by P14) that occur within the rare spaces that afford trans people to cease being vigilant. Developers, human agents, and state officials have not earned access by obliging to frameworks within safer spaces, yet, as P14 described, they have crossed a line into these spaces, at least partially through VAIs, and some participants feel that breach.

In such an environment, it is no surprise that our participants view these technologies as risky, and efforts at inclusion as potentially dangerous. Increasing the acceptability, use, and presence of VAIs through mediums such as persona representation and voice analytics is ultimately, as Heather Woods puts it, "a strategic move for surveillance capitalists, who may mobilise this reliance to gain access to increasingly intimate types of information about their users, and then extract and alienate the data from consumers" [73, p.345]. As previously discussed, this extraction of data may be utilised to manipulate user behaviour.

The concerns of trans and/or non-binary individuals regarding the expression of power dynamics in design are manifold. As mentioned, the use of trans and/or non-binary personas may place trans users at heightened risk for data extraction (which will be discussed in the following section). Developers' relation and contributions to dominant ideologies were also raised by participants, demonstrating the unsurprising relevance of these ideologies to trans needs and safety. Three participants were concerned with VAIs being developed within capitalist, patriarchal, and white-dominant frameworks and structures of power, fearing that the development and distribution of these devices would result in the amplification of those ideologies, and the power disparities interwoven with them.

Participants narrate an image of both VAI and broader society as already permeated by these ideologies (with P15 adding fascism to this image), which collectively serve as a source of the

lack of safety trans people experience. Concerns with the social nature of human-VAI relationship being leveraged towards emotional manipulation (as described by P12), are in line with Nass & Brave's depictions of how VAI design may strengthen affective ties between users and technology, leading to more and more intimate engagement [48]. Heightened by personalised responses derived from voice analytics [43], effective VAI persona design may create engagement feedback loops that increase the susceptibility of users to data collection and surveillance.

The social nature of human-VAI relationships presents the risk that as relationships increase in intimacy, users more passively accept responses and instructions delivered by their devices. As the ubiquity of VAI increases, so does their role as gatekeepers to the labour market, e-commerce, and information including news outlets. This places VAIs in a position of great influence social and political discourse via the delivery of content (driven by commercial algorithms) that users may not question [25, 67]. From participants' descriptions of the ways in which they navigate psychological, emotional, and physical threats to their safety, it is clear that an exacerbation of the ideologies and dynamics discussed above may further reduce trans safety.

5.3 Trans-Specific Vulnerabilities

Our highlighting of wider structural factors above is not meant to imply that there are no trans-specific concerns with data collection and (mis)use. To the contrary—as illustrated in part by the nature of participants' fears regarding data, privacy and safety discussed above—there are clearly trans-specific concerns within the tensions we raise.

One prominent example concerns developer intentions and profit motives. While issues within capitalism are not specific to queer and/or trans people, many scholars highlight the notion of “pink capitalism”. Pink capitalism is a specific form of capitalism, one in which organisations use the surface-level, representational inclusion of queer and/or trans lives to legitimise or encourage participation in otherwise harmful systems. Several scholars, including Emmanuel David and Dean Spade, note trans-specific forms of this phenomenon [18, 63]. Oliver Haimson, Denny Starks and colleagues raise this issue within HCI, noting the tension it produces in designing more inclusive systems [24].

Our participants pointed to this mistrust when addressing both the subject of representation and that of gender competency by their devices. This highlights the particular relevance of looking beyond surface-level “inclusion”, and the need, as part of this, to attend to the histories of inequality that characterise trans experiences of society and technology [35, 58]. By this we mean developers meaningfully engaging with the history, and present, of their users' experiences. This means they cannot address a lack of representation as a bug to be fixed. It is a feature of the wider social context, tightly bound to the violence and ignorance that has characterised prior engagements between trans and/or non-binary users and commercial developers. This violence impacts developers' and users' understandings of each other, and must be actively worked *against* to create the trust relationship needed for informed VAI.

Representation within VAIs, if not paired with work to meet trans and/or non-binary users' privacy needs, may serve as a “surveillance trap”. A trap that exploits their specific hardships and desires for safety to lure them into intimate adoption. Our participants identified gender affirming personal relationships as sources of safety, which combined with their lacking of a regular sense of safety, may make them particularly vulnerable to VAIs that mimic interactions that make them feel comfortable. Aside from concerns that representation-oriented work distract from more pressing changes within VAI systems, four participants explicitly stated concerns with a resulting increased susceptibility to engagement by trans users. Seemingly safe spaces developed through digital tools have set the stage for harm to be inflicted on trans people in the past [58].

It is crucial to understand the dangers of corporate delivered comfort. In a similar way that cisgender female voice representation in VAIs eases mainstream users' anxieties around use [73], trans users' positive perception of gender affirmation and representation in VAIs may increase their trusting of these devices, which has been identified as one of the greatest barriers to adoption [51]. Assuming notions of affective human-voice technology relationships (Ness and Brave), gender affirming and representative design may prevent their replication of cisnormative social dynamics, paradoxically, at the cost of trans and/or non-binary individuals' privacy.

As the nature of human-VAI interactions increases in intimacy, so may the ability for VAIs to become more competent of trans users' gender, increasing their digital visibility. Participants richly described their tensions and complex relationships with notions of trans visibility. Some participants described a sense of safety with being able to hide their trans identity, which came alongside a sense of their identity being erased (P11). Others, described a desire to be as visible as possible, which came alongside concerns of threats to their safety (P14). Some described how risks present within these tensions may be aggravated by technology, most of which included threatening entities accessing their personal information.

Many specific concerns can be illustrated by the concept of *context collapse*: the unexpected blurring of information and participants from two separate social spheres, leading to an unwilling loss of privacy and compartmentalisation [8, 70].⁴ These include "outing" (having one's trans identity disclosed without consent), gender-motivated cyberbullying, and gender-motivated doxxing (the publishing of personal, identifying information of a person online with the intent to harm) [35, 58]. As Schueurman *et al.* found in their examinations of trans experiences of online spaces [58], our participants identified groups including white supremacists, trans-exclusionary feminists and law enforcement—who developers have, as discussed, frequently shared data with [25, 67]—as particular threats.

An individual's trans identity can be weaponized, and for this reason, it is understood that trans communities need differentiated security measures to mitigate threats and enable them to fully benefit from technological tools. Participants described possessing autonomy over how much (or little they) spoke about their gender when describing safer spaces, a quality closely resembling their need for control over their data (with participants pointing to not wanting to feel obliged to disclose any information, and always being able to edit or delete information). Design that does not account for trans users' needs leads to technology that disproportionately harms them [65], and for this reason, VAIs that engage the needs and experiences of trans users must account for their heightened risk of violence and harassment by enabling them agency over disclosure through design.

Issues of "pink capitalism" reinforce the concerns about the limitations in representation-oriented fixes to technological injustices. Rather than presumptively taking a representation-oriented approach, efforts to reduce the potential harms of VAI to trans people, in other words, must consider how trans people experience gender in practice, and the wider structural relations of power in which they exist. As illustrated by P15, the relationships between technology, capitalism, the state, and mainstream ideology are widely detrimental to the material realities and needs of trans people. A proper consideration of trans needs within VAI systems would thus address issues within these relationships as they perpetuate trans oppression. This includes (but is not limited to) the lack of physical, emotional, and psychological safety regularly experienced by trans people.

⁴Context collapse itself draws on notions of "contextual integrity"[49] as the inverse, and as a way of considering what information exposure is and is not appropriate. We choose to discuss these issues in terms of context collapse, rather than contextual integrity, because we feel that the literature on context collapse is more directly applicable to the domains we are discussing in this paper.

But trans people—our participants explained in detail—are more than their genders, or gendered trajectories; they are also participants in wider social structures, relations and injustices. Design for marginalised groups frequently takes the form of designing for issues specifically and uniquely experienced in relation to that marginalisation. Correspondingly, treating trans-inclusive design as *identity specific* has not only been critiqued by participants but would also leave race, disability, class and other aspects of experience unmarked—and so in practice, is likely to produce solutions that are only truly solutions for those trans people who—absent solely gender-based injustices—live comfortably.

In order to properly account for the needs and experiences of trans individuals within technology, concerns beyond simply representing some fixed notion of an identity must be considered in design. In the case of VAI design, these concerns include surveillance and a lack of data autonomy, corporate ideological manipulation, concerns with developer's relationship with the state, and the mistreatment treatment of workers. Such an approach to VAI design may rectify the perpetuation of both the general and trans-specific harms and vulnerabilities associated with this technology (P9, P13).

6 DESIGN RECOMMENDATIONS

Our discussion above highlighted the ways in which truly trans-inclusive design requires more critical attention to the micro and macro structures that VAIs influence and are influenced by, along with a centering of articulated and prioritised, rather than assumed, trans needs. In this section we reformulate these themes into a series of recommendations for designers and developers seeking to reduce the potential harms caused by VAI. These recommendations include:

- (1) Designing with and for **trans-specific privacy considerations**;
- (2) Developing **features for trans-specific purposes**;
- (3) Creating **representative and gender-affirming VAI personas**, and;
- (4) Basing the development of these features in a **grounded and participatory design process**.

While these proposals are—on the surface—achievable within the current dynamics of the AI industry, more substantive and meaningful engagements with trans needs require structural changes and alternatives. To that end, we also suggest some directions for researchers or designers interested in deeper engagement with creating alternative sociotechnical systems in which VAI can be developed and disrupting harms within current systems.

6.1 VAI Design Requirements

One set of recommended changes pertain to the process by which this software is designed, and the features that are developed. At the very least, our participants' experiences demonstrate the way in which designing software for a community or trajectory from outside leads to a misunderstanding of users' needs and priorities. Correspondingly, a clear lesson is the need for trans perspectives to be involved in the design process. This requires a more *grounded and participatory design process*, rather than, as Alex A. Ahmed discusses, developers and designers simply soliciting trans participation in user studies after the fact [2, p.94].

Involving trans users in developing the very ideas of what features should be developed and what directions software should go in is key. In the wider CSCW and HCI space, there are already efforts to do this through participatory design and/or design workshops, including not only the work of Ahmed but (more recently) Oliver Haimson, Dykee Gorrell, Denny Starks and Zu Weinger [24]. Crucially, such involvement should not be constrained to situations where developers decide by fiat what trans interests are relevant—it is clear, from our participants' perspectives, that trans lives are about far more than gender.

Our findings—grounded as they are in the perspectives of trans users of these technologies—suggest some concrete changes developers should consider for meeting trans needs. One of these is the opportunity to create *representative and gender-affirming VAI personas*. This implies that design prioritise not gender clarity but gender instability, enabling user freedom in determining the nature of their VAI’s voice, the gendering of its persona, and the pronouns it uses when referring to users. All suggestions by participants regarding gender-affirming and representative user-facing design pointed towards designing for flexibility: enabling users to modify their software in order to meet as many needs as possible. Such a suggestion aligns with the politics and practices of CSCW more broadly, which frequently recognises the importance of allowing space for users to adapt [20].

Another is incorporating trans-specific purposes, which as touched on, include utilising VAIs to support healthcare that encompasses trans peoples’ needs, incorporating queer and/or trans-specific data to connect users to content that is relevant to them, and providing feedback on community spaces and the relative safety of new places (accounting for potential race, class and other biases design) particularly given the strong integration of most VAIs with mapping software. These features may serve as crucial interventions that relieve this population’s vulnerability to violence, cumulative administrative difficulties, ill health, and shortened life spans [30, 37, 63].

The development of VAIs that explicitly “move beyond merely ‘allowing’ trans people to exist” [2] would help bridge disparities experienced by this population under structural cisnormativity by providing material improvements that enhance their “embodied wellbeing” (comfort in one’s identity, selfhood, embodiment, sexuality) [28].

We also conclude that privacy is, quite clearly, the foundational requirement of trans-competent VAI design for many users. Participants expressed wanting transparency, regulation, and control over their data collection and use. VAIs that successfully address the need for *trans-specific privacy considerations* must offer a shift in power relations where users are not bound to offer data by default but rather can autonomously opt in to providing information if desired.

Contextualised within a sociopolitical context where trans individuals experience disproportionate physical violence [37], and digital threats [35, 58], it is crucial that developers support the unsanctioned opting out of data collection by incorporating permissions into service design that ease users’ ability to personalise their privacy preferences [22], enable users to modify or delete their data, and omit gender as a variable for categorisation unless required for specific purposes agreed upon on by users (in which case, relying on self-identifying practices) [34]. Developers should integrate differentiated security programs in order to provide a higher and specified level of privacy protection that meets their specific needs [35].

6.2 Changing the Conversation

Yet, while we encourage the development of more participatory design processes and community-oriented features, we do not want to lose awareness of the wider structural forces in play. Existing VAIs are mostly developed in a profit-oriented context, one in which data extraction and surveillance capitalism are fundamental to developing organisations’ business objectives, and where data has been noted to be shared with state institutions. This orientation ultimately limits the efficacy of reform-oriented changes to design: the incorporation of trans people in the design process alone (as noted by one participant), for example, is unlikely to change the distribution of power in a way that gives trans users meaningful control over the purpose of the software and its business objectives. The inclusion of trans needs is—while certainly better than not including them—is also susceptible to issues of pinkwashing and surveillance trapping, as discussed in Section 5.3.

Correspondingly, while we endorse and advocate those changes, we also want to advocate that researchers and designers working in this space go further, and think about ways of evading or destabilising harm within these structures. In line with Drouhard, Hoy & Keyes’s “Anarchist

HCI” [31], this consists of working not simply to not further empower forces of surveillance, control and normalisation, but to “actively build systems that undermine such actors”.

One part of this is to take the proposed new features and design considerations discussed above, and seek to embed them in grassroots development efforts driven by and accountable to trans communities. As noted by some participants, in order to properly account for a redistribution of power and the proper treatment of workers within these developments, they must also operate within a user-owned cooperative and democratic model that includes a wide range of marginalised identities (even within the trans community). Such an approach aligns with user’s desires for translated VAI development, and (interrelatedly) potentially addresses concerns about privacy by avoiding vast data silos in favour of a multitude of smaller organisations. Note that it is not enough to simply undertake development in a “non-profit” environment; as Manazala & Spade have argued [39], drawing on the work of *INCITE! Women, Gender Non-Conforming, and Trans people of Color Against Violence*, [27] non-profit organisations around queer rights and liberation, including trans liberation, frequently fall into organisational traps which drastically reduce their efficacy and accountability.

Further, grassroots-driven efforts are far more equipped to integrate several of the suggested features—particularly those relating to community safety and events, many of which are known primarily through tacit knowledge within trans communities—and be responsive to changing circumstances and needs. Community-led and communally accountable development efforts also offer the opportunity to prototype new relationships around data exchanges. Reinforced by meeting the needs for trans-specific privacy and trans-specific purposes, users providing information within these systems could willingly contribute to amplifying the technological capacities of systems designed specifically for trans people.

These alternative sociotechnical systems may strengthen community collaborations towards the collective betterment of trans lives, aligning with emancipatory HCI practices where developers are treated as “accomplices and not overseers” [31]. Explorations of speculative design prototypes for VAIs that meet all user needs may serve as next steps in the development of these systems.

Another, however, includes actively seeking to disrupt harmful aspects of existing systems, which in the case of VAIs, greatly revolve around the aggravation of privacy breaches through the medium of voice. Grassroots development efforts are more flexible than vast infrastructures, but also more fragile and harder to sustain. Making space for trans users in an environment dominated by those infrastructures thus requires not only alternatives, but—recognising that the continued use of existing systems is inevitable—disrupting the harms those systems produce. One approach to take, particularly around privacy, is to follow the example laid out by Brian Schram, who argues for users and developers to disrupt data collection by engaging in “cloning”, generating data traces that represent “dozens of false selves” along each real identity in a data store [61].

In the case of trans concerns around privacy with VAIs, this would consist of (for example) opposing the enhancement of data profiles through voice analytics by feeding masses of artificial conversation and information into VAI systems, drowning the databases in false information, and so both reducing the probability of trans data coming under human review, and the value proposition of data collection as a way to improve and refine developers’ understanding of the world. Such an approach is suggested in discussions of design for HIV stigma and disclosure (REFERENCE ANONYMISED FOR REVIEW), and seems highly applicable here.

Approaching the question of trans competency through a diversity of tactics, including not only reformist changes to the design of software but efforts to challenge the nature of the systems and contexts in which design is undertaken, is likely to prove far superior to an either/or approach. Ultimately, our point is that there is no single solution to trans-competent design with VAIs—just as there is no single ‘non-binary voice’ around which they should be designed.

7 CONCLUSION

Trans and/or non-binary communities are greatly omitted from discourse surrounding the social implications of VAI design. When included, their needs are assumed and pinned to issues of representation within VAIs. Our study provides a comprehensive scheme of trans needs and experiences within VAI technology. We highlight that beyond voice, this community requires vast software changes that address their concerns around trust, privacy, and motives. These concerns are not exclusively specific to trans people, but failure to tackle them has implications for trans-specific vulnerabilities within both digital and more material environments.

We provide some suggested tactics aimed at both undermining cisnormative assumptions in technology design while simultaneously addressing trans people's most pressing material concerns. Attempts to include trans perspectives should not stop at including trans people in persona design. On the contrary, representation without privacy is a surveillance trap; it may lure trans users into engaging more intimately while not resolving privacy issues. In order to ensure that trans people are properly accounted for, our identified user needs must build on each other, with trans-specific privacy being a foundational requirement for VAIs.

Considering constraints within the commercial contexts where these devices are currently developed, we suggest that researchers and technologists go further and work outside these structures towards developing grassroots VAIs driven by and accountable to trans communities, while employing strategies for disrupting the aggravation of digital privacy breaches through the use of voice analytics. In this way, they may amplify the technological capacities for addressing issues facing trans and/or non-binary people, and work on dismantling elements of existing systems that are fundamentally harmful. Similar research and development across branches of AI may inform other interventions that reconfigure, re-purpose, and dismantle harmful elements of this technology, supporting user self-determination, and with that, trans and/or non-binary lives.

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