Designing Beyond Fluency: Imagining Speech Technology through Speculative Design with People Who Stutter

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Abstract

Speech technologies are often designed and optimized for the experience of a "fluent user" who speaks continuously, quickly, and within tight timing boundaries. For people who stutter (PWS), these underlying assumptions can result in usability challenges, stigma, and exclusion. This paper reports a mixed-methods study with PWS in China that consists of a survey (n = 53) and participatory speculative design workshops (13 participants), examining how PWS experience and reimagine communication systems structured around fluency and speed. Our findings show that many challenges faced by PWS are not primarily about speech itself but about how communication systems are designed, such as timing constraints, synchronicity requirements, and interaction structures that treat slower or more variable speech as error. Through a speculative design exercise we call the "Stuttering Planet"—a society in which stuttered speech is the communicative norm—participants moved from designing tools that help individuals cope with fluency-centered systems to reimagining those systems themselves. Our work contributes an empirical account of how fluency norms constrain design imagination, a methodological argument that the framing of a design task shapes what participatory design surfaces, and a conceptual reframing of speech accessibility as a temporal and infrastructural condition.

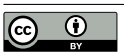
CCS Concepts

• **Human-centered computing → Empirical studies in accessibility**.

Keywords

stuttering, speech technologies, accessibility, design justice, speculative design

ACM Reference Format:
Peiyao Liu, Jingjin Li, Rebecca Lietz, Shaomei Wu, and Norman Makoto Su. 2026. Designing Beyond Fluency: Imagining Speech Technology through Speculative Design with People Who Stutter. In *The 28th International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS '26), October 25–28, 2026, Vila Nova de Gaia, Portugal.* ACM, New York, NY, USA, 15 pages. https://doi.org/10.1145/3797867.3828991



ASSETS '26, Vila Nova de Gaia, Portugal

ACM ISBN 979-8-4007-2521-0/2026/10
https://doi.org/10.1145/3797867.3828991

1 INTRODUCTION

Speech technologies increasingly mediate how people participate in everyday life, from voice assistants and smart homes to transcription and communication tools. These systems promise seamlessness and universality. Yet this promise is often built on the narrow assumption that users speak fluently, continuously, and within the system's anticipated time bounds. These assumptions are rarely made explicit, but they shape who can participate in communication systems, how interaction proceeds, and what counts as successful communication. For people who stutter (PWS), these assumptions become particularly visible. Stuttering has traditionally been understood as a speech impairment located in the individual speaker, and both clinical interventions and speech technologies have largely followed this framing, treating disfluency as a problem to be reduced, corrected, or concealed [57]. Recent research and advocacy have challenged this view, framing stuttering as a sociocultural phenomenon shaped by norms of communication, productivity, and competence [19, 63]. The adverse effects of stuttering, including cognitive and emotional impacts [11, 24], socioeconomic penalties [12, 34], and social stigma [14], are often not produced by disfluency itself but by the social and technical structures that surround it [19].

HCI and accessibility research have responded with work that centers disabled users as designers rather than subjects of remediation [60, 73]. Within speech technology, prior work highlighted how interaction structures such as timing constraints, endpointing, and turn-taking expectations disadvantage PWS [52, 61, 64, 89]. Speech AI research has also made important progress in improving recognition accuracy and developing assistive tools for people with diverse speech patterns [4, 51, 53, 58]. Work with stuttering communities also moved from purely corrective approaches toward designs that integrate social connection, emotional support, and community governance [28, 55]. Prior work in design justice and critical participatory design has begun to question whether participation alone is sufficient to surface structural critique [22, 38], but the question has received limited empirical attention in accessibility research with communities shaped by sustained stigma.

In this paper, we ask two questions, one empirical and one methodological. **RQ1.** How do people who stutter envision speech technologies for themselves and their community, and how does

their vision align with the community's values? **RQ2.** When the same participants design under two different task framings, how do their designs differ, and what does that difference reveal? One framing treats fluency-centered communication as fixed; the other treats it as open to redesign. We approach this through a mixed-methods study with PWS in China, including an online survey (n = 53) and participatory speculative design workshops (13 participants across 4 sessions). The workshops asked the same set of participants to articulate their core values, design speech technologies for their present lives, and finally imagine communication on a "Stuttering Planet" where stuttered speech was the communicative norm. This scenario was designed to support structural rather than merely adaptive imagination among participants for whom fluency norms had become deeply internalized [33, 76, 84].

This study makes empirical, methodological, and conceptual contributions. First, as an empirical contribution, we document a gap between values and design: participants who critiqued fluency norms nonetheless designed within them when asked to design for their present lives. This shows that internalized norms—rather than a lack of participation, critical framing, or creativity—constrain design imagination, and that participation alone is insufficient to surface structural alternatives in communities shaped by sustained stigma. Second, as a methodological contribution, we show that how a design task is framed shapes what participants can imagine and propose: when we displaced fluency as the communicative default through a speculative scenario, the same participants who had designed adaptively for the present produced designs that restructured communication itself. We offer task framing as a methodological lever for surfacing structural critique. Third, we contribute a conceptual reframing of speech accessibility as a temporal and infrastructural condition. Rather than treating disfluency as a problem of speech recognition or individual performance, our findings show that many of the barriers participants encountered stem from temporal expectations embedded in communication systems: fluency operates not only as a linguistic norm but as a temporal structure that shapes participation. This reframing shifts the focus of design from improving individual fit to reconfiguring the conditions under which communication occurs.

2 RELATED WORK

2.1 Fluency, Speech, and Social Norms

Fluency has long been treated as the expected norm in clinical and social contexts, while speech disfluencies are viewed as deviations that should be corrected or hidden [77, 80]. Traditional speech therapy approaches for stuttering have historically prioritized observable fluency over broader well-being [16]. Such fluency-shaping techniques are often difficult to maintain, feel unnatural to PWS [49], and lack strong evidence for long-term benefits [26]. Despite recent research showing the efficacy of disfluency-affirming speech therapy in building positive self-identity and promoting the long-term well-being of PWS [20, 75, 80], fluency-driven goals and approaches remain dominant in the speech-language pathology field [35, 75]. This reflects broader medical and social pressure equating fluency with competence. These fluency norms are temporal as well as linguistic, and disability scholars have both named and contested them. Freeman's concept of chrononormativity describes how institutions organize bodies around expected paces and rhythms, positioning those who deviate as inefficient or incompetent [30]. Crip time, developed within disability studies, names the refusal of the assumption that a single normative pace should govern participation [50, 69]. To speak "fluently" is, in large part, to speak on time.

Fluency norms contribute to widespread stigma. PWS routinely encounter negative social reactions and cultural misconceptions that associate stuttering with shyness, nervousness, or incompetence [15]. Such associations contribute to bullying, social rejection, and internalized stigma, leading to lower self-esteem and negative well-being outcomes [10, 13]. Research on stuttering experiences in China suggests a stronger social stigma towards stuttering than in other regions. Chinese PWS reported more adverse experiences related to stuttering and less access to professional support than in Western contexts, partly due to pervasive negative social attitudes and limited awareness [40, 54, 59]. These findings underscore the social pressure and structural marginalization our participants are experiencing, providing a useful context for our survey and co-design studies.

Stigma and fluency expectations are deeply embedded in technological systems. Technoableism, in which technologies are designed to make disabled people appear or act "normally," frequently shapes design choices [37, 71]. Disability scholars have shown how technologies often assume a neurotypical "standard user," leading to top-down, corrective, or curative design approaches that rarely incorporate disabled communities' perspectives [42, 57, 65]. Such top-down approaches reproduce power imbalances in accessibility design, and can result in "disability dongles" rather than tools that meet real user needs [47, 65]. Within stuttering communities, activists resist correctionist ideologies, question the medicalization of speech restructuring for aesthetic reasons [66], and build affirmative narratives that celebrate speech diversity [20, 63].

2.2 Speech Technology for People Who Stutter

Stuttering behaviors vary widely across and within individuals, ranging from overt repetitions to covert behaviors like word substitution and avoidance [19, 81]. This variability poses challenges for machine learning techniques that often rely on statistical methods or pattern recognition. For example, automatic speech recognition (ASR) systems often struggle to recognize stuttered speech, showing word error rates as high as 50% in cases of severe stuttering, which is ten times higher than the average of fluent speech [52]. Beyond ASR, a wide range of everyday communication technologies, such as telephony, videoconferencing (VC), and voice interfaces, can further disadvantage PWS by prioritizing the verbal channel, undermining PWS's ability to leverage non-verbal communication strategies [48, 89, 90]. These systems perform poorly for stuttered speech due to hardcoded silence thresholds and the inability of language models to decode partial words or interjections [52, 61]. Such failures can lead to both functional inaccessibility and emotional harm [9, 52], further penalizing the stuttering community in the workplace [34] and mental health outcomes [24].

Even technologies designed specifically for PWS, such as SpeechEasy[1] and Whispp[2], primarily aim to mask disfluency rather than accommodate it. SpeechEasy uses delayed auditory feedback (DAF) to smooth speech rhythms, and Whispp uses AI-powered voice conversion to make stuttered speech sound fluent in real-time. These tools are valuable for specific situations, but the underlying design commitment that disfluent speech should be made to sound fluent reinforces the ableist assumption of fluency as the communicative standard [35, 63, 77]. Recent accessibility research in adjacent domains has explored more holistic, co-designed interventions. For example, Bircanin et al. [8] worked with people with aphasia to reimagine audio-media as a source of intimacy, recovery, and social connection. Design for real accessibility requires technologies that engage with speech diversity and adapt to users' rhythms rather than requiring users to adapt to the machine's pace.

2.3 Participatory Design and Speculative Design in Accessibility Research

Accessibility research has increasingly moved toward participatory and community-centered approaches, positioning disabled users as co-designers rather than as subjects of accommodation [60, 73, 76]. A growing body of work demonstrates the value of this approach, from co-designed communication tools with people with aphasia [8] to community governance frameworks developed with stuttering communities [55] to inclusive interfaces developed with neurodivergent users [76]. A commitment throughout this work is that extending design agency to disabled communities surfaces designs grounded in community values rather than in the assumptions of outside designers. This commitment to treating values as something explicitly designed for, rather than an incidental outcome, connects to a longer tradition of value sensitive design in HCI [32], on which our values-elicitation activity (Section 3.2.2) draws. However, design justice research has argued that participatory methods do not automatically surface structural critique, and that dominant norms shape what participants treat as a design possibility [22]. Harrington et al. [38] showed how community-based participatory design with Black communities often reproduced dominant framings, and argued that equitable participatory engagements require deliberate methodological work rather than the inclusion of marginalized participants alone. Another concern about empathy-based design with disabled users is that empathic modes can reproduce ableist framings even when designers and disabled collaborators intend otherwise [7]. The implication of this critique is that participation is a necessary but not sufficient condition for design work that challenges the systems marginalized users live within. What methodological moves are needed to make participation sufficient, particularly for communities shaped by sustained stigma, remains an open question in accessibility research.

Several methods have been mobilized to address the gap between participation and structural critique. Speculative design is one such approach. Speculative design is a critical and imaginative approach for surfacing and challenging the values embedded in current technological assumptions by engaging participants in imagined sociotechnical futures [17, 33]. Rather than offering immediate solutions, it provokes critique, exposes embedded values, and expands the range of design possibilities [3, 87]. Typical processes include framing the problem, imagining alternative futures, developing narratives, and facilitating reflection to support collective creation [17]. In accessibility and disability-centered design, speculative design surfaces trauma, systemic issues, and deeply embedded narratives by challenging what is considered "normal" in society and technology design [2, 17]. Deaf-led and disability-justice-oriented speculative design works, such as *Eyeth*, relocate participants to fictional worlds, creating distance from existing medicalized and audist paradigms [2]. Related approaches, from critical fabulations [67] to participatory speculation [27], emphasize belonging, agency, and imagination over correction or cure. Within HCI, methods such as Futuristic Autobiographies [18] have used participant-authored speculative narratives about future technologies to surface values and perspectives. These methods vary in form but share a commitment that surfacing structural critique requires specific methodological work. Our paper contributes to this by contrasting designs for the present world with design within a scenario where the dominant norm has been displaced, showing that the framing of the design task shapes what participatory engagement surfaces.

3 METHODS

This study used a mixed-methods design. An online survey established the breadth of PWS's experiences with speech AI and shaped the specific challenges, contexts, and tensions we brought into the workshops. The co-design workshops then allowed us to explore, with depth and participant voice, how PWS interpret those experiences, what they value, and how they imagine alternatives.

3.1 Speech AI Products Survey

3.1.1 Participants and Recruitment. We recruited participants who self-identified as people who stutter through a stuttering advocacy and support organization in China. A total of 53 participants completed the survey. We refer to survey respondents as S1 through S53. Participants represented a range of age groups, genders, educational backgrounds, occupational contexts, and self-described stuttering experiences (Table 1). Each survey took approximately 20 minutes. Participants received 30 RMB with the option to donate their compensation to a designated stuttering community fund.

3.1.2 Survey Design. The survey was designed to understand Chinese PWS's everyday experiences with speech AI technologies, including perceived barriers, impacts, benefits, and desired improvements. It combined Likert-scale, multiple-choice, and open-ended questions across four areas: stuttering background and psychosocial experience; frequency of use across speech AI product types; perceived task difficulty and reasons for non-use; and barriers, life domain impacts, and desired features. Quantitative items were analyzed using descriptive statistics, and open-ended responses were analyzed qualitatively.

[1] https://speecheasy.com/how-it-works/
[2] https://whispp.com/

Table 1: Demographics of Survey Participants (N = 53)

Category	Distribution
Gender	Men: 66.0% (n = 35)
	Women: 34.0% (n = 18)
Age Group	18–24: 15.1% (n = 8)
	25–34: 67.9% (n = 36)
	35–44: 15.1% (n = 8)
	45–54: 1.9% (n = 1)
Stuttering Experience	Covert: 18.9% (n = 10)
	Mild: 35.8% (n = 19)
	Moderate: 37.7% (n = 20)
	Severe: 7.5% (n = 4)

3.1.3 Survey Summary and Insights. Three patterns were particularly consequential for subsequent workshop design. First, stuttering severity was most pronounced in time-pressured and socially evaluative situations. More than half of participants (57%) reported at least sometimes experiencing noticeable disfluency when ordering food, rising to 70% when speaking with strangers, 74% when speaking on the phone, and 89% when speaking in front of a group. While interactions with familiar people were somewhat easier, around half of the participants (49%) reported noticeable disfluency at least sometimes even among acquaintances. This pattern suggested that temporal pressure and social evaluation were defining characteristics of difficult situations. Second, the psychosocial costs were substantial. More than 45% of respondents experienced significant physical tension during stuttering episodes, and a similar proportion reported strong or very strong emotional stress or anxiety. Approximately 70% reported frequent avoidance. These findings highlight the embodied and affective costs of communication under time pressure. Third, speech AI use was widespread but often challenging for PWS. Over 90% of participants had used at least one speech AI product, with voice assistants (81%), automated voice customer service (75%), voice-controlled devices (62%), and language translation tools (58%). Major difficulties included transcription errors (66%), unrecognized or interrupted input (58%), and inaccurate output content (49%).

3.2 Co-design Workshops

Building on the survey findings, we designed a series of co-design workshops to explore how PWS envision inclusive speech AI systems. Informed by previous design research [33, 87], we adopted speculative design to create a critical distance from existing sociotechnical systems and enable participants to imagine alternative speech technologies not centered around fluency. The Stuttering Planet prompt was developed iteratively, and its final form was shaped directly by participants' responses to an earlier version. Participants recorded and organized their ideas as written notes on the shared Miro board. In an initial pilot session, we asked participants to imagine speech technologies 10 years from now, when society has fully accepted stuttering as a valid form of speech. The prompt we used is shown in Figure 1. The designs produced remained incremental extensions of current tools, oriented toward improving speech fluency and efficiency for PWS. We observed that participants critiqued fluency norms explicitly, but still designed to fit those norms. This observation suggested the depth of internalized stuttering stigma, which constrained participants from imagining radical alternatives [13]. Several participants even raised questions about *how* stuttering could come to be socially accepted in 10 years, indicating strong disbelief in this speculative setting. The participants' questions and comments prompted the research team to realize that, although the temporal horizon had been extended, it was insufficient to move the normative frame, since imagined futures often inherit the normative assumptions of the present [3, 83, 84]. In response to this participant feedback, we revised the prompt, drawing on speculative design work with the deaf and hard of hearing (DHH) community [2] to develop the Stuttering Planet scenario: rather than asking participants to extend the present forward, it relocated participants to a world where stuttered speech was already the norm, giving them a position from which to examine present assumptions as choices rather than givens. The detailed protocol for the workshops is described in the following section.

3.2.1 Participants and Recruitment. We recruited workshop participants through two channels: survey participants who indicated interest in a follow-up workshop, and Chinese stuttering community advocates contacted through existing networks. All participants self-identified as PWS and were over 18 years old. A total of 13 participants attended four workshops, with three to four participants per session. Each participant received 180 RMB compensation for their participation. For participant details, see Table 2.

3.2.2 Workshop Procedure. Workshops were conducted over Zoom, each workshop lasting 90-120 minutes, utilizing Miro Boards[3] for collaborative activities. Each workshop proceeded through five stages.

[3]https://miro.com

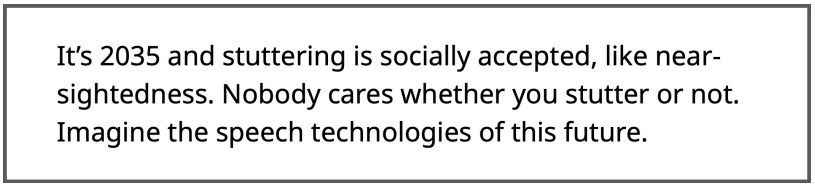


Figure 1: The pilot workshop prompt asking participants to imagine speech technologies in a future where stuttering is socially accepted.

Table 2: Workshop participant demographics and stuttering-related characteristics, including age ranges (18–44), professional backgrounds, self-reported stuttering severity, negative thoughts related to stuttering, and frequency of avoiding stuttering in speaking.

Workshop	ID	Age	Current Field	Stuttering Severity	Negative Thoughts	Avoidance
W1	P1	25–34	Freelance	Severe	Severe	Often
	P2	25–34	Mechanical Design	Mild	Severe	Often
	P3	35–44	AI	Moderate	Mild	None
W2	P4	25–34	Student	Moderate	Mild	Sometimes
	P5	25–34	Education	Covert	Moderate	Always
	P6	25–34	Renewable Energy	Covert	Mild	Mild
W3	P7	18–24	Student (Food Science)	Moderate	Mild	Sometimes
	P8	25–34	Java Developer	Moderate	Moderate	Sometimes
	P9	35–44	Communication Science	Moderate	Moderate	Mild
W4	P10	35–44	Food R&D	Moderate	Moderate	Often
	P11	25–34	AI Research	Mild	Mild	Sometimes
	P12	25–34	Energy & Environment	Moderate	Severe	Sometimes
	P13	25–34	AI Data Quality	Mild	Moderate	Moderate

(1) **Welcome and Icebreaker.** Participants introduced themselves and shared one positive aspect of living with stuttering. This established an affirming and non-deficit-oriented atmosphere before any design work began.
(2) **Identifying Personal Values.** Acceptance and Commitment Therapy (ACT) is a therapeutic approach that fosters psychological flexibility, including through the clarification of personal values to guide action [41]. Our design called for participants to articulate what they valued before designing, so that their subsequent design choices could be examined against those stated values; ACT's values offered a validated, structured vocabulary well suited to this purpose, letting participants name what they care about concretely rather than in the abstract. Participants selected and sorted personal values from ACT on the Miro Boards, then discussed how stuttering has shaped those values, where values conflicted with lived experience, and how technologies might support or threaten them.
(3) **Designing for the Present.** Grounded in challenges identified by the survey, participants brainstormed speech AI ideas for their current lives. Individual ideation preceded group discussion, which allowed participants to develop ideas before the collective exchange. Discussion then surfaced tensions between participants' needs, values, and the constraints of existing systems.
(4) **Imagining Speculative Futures.** In the "Stuttering Planet" exercise, participants envisioned a world where stuttering was the communicative norm. They imagined and described how this society would be organized, what speech technologies would exist, and how communication infrastructures would differ from those of the present. Facilitators also encouraged participants to consider what communication would look like if fluency were no longer the standard. The Stuttering Planet prompt, as presented to participants, is shown in Figure 2. Figure 3 shows sample responses to this prompt from P10 and P13.
(5) **Reflection and Closing.** Each workshop concluded with an open reflection on what participants found meaningful or unexpected and how their imagined planet contrasted with their present-world designs.

3.2.3 Data collection and analysis. All workshops were video-recorded with participants' consent. Data sources included Zoom recordings, translated transcripts, and Miro board artifacts. We used an inductive open-coding analysis approach [68] to conduct the thematic

After years of space exploration, a mysterious planet has sent us an invitation. You, as a key member of the interstellar exploration team, have landed on this never-before-seen planet, alongside your teammates. We've traveled through the vastness of space, and now we are about to uncover the secrets of this extraordinary world. This little-known planet is home to a society made up entirely of people who stutter. Their world is nothing like the one you're familiar with. Everyone speaks with a unique rhythm. They do not aim for fluent or complete sentences. Instead, repeated words, rhythmic pauses, and extended syllables are part of everyday conversation.

Figure 2: The Stuttering Planet workshop prompt as presented to participants.

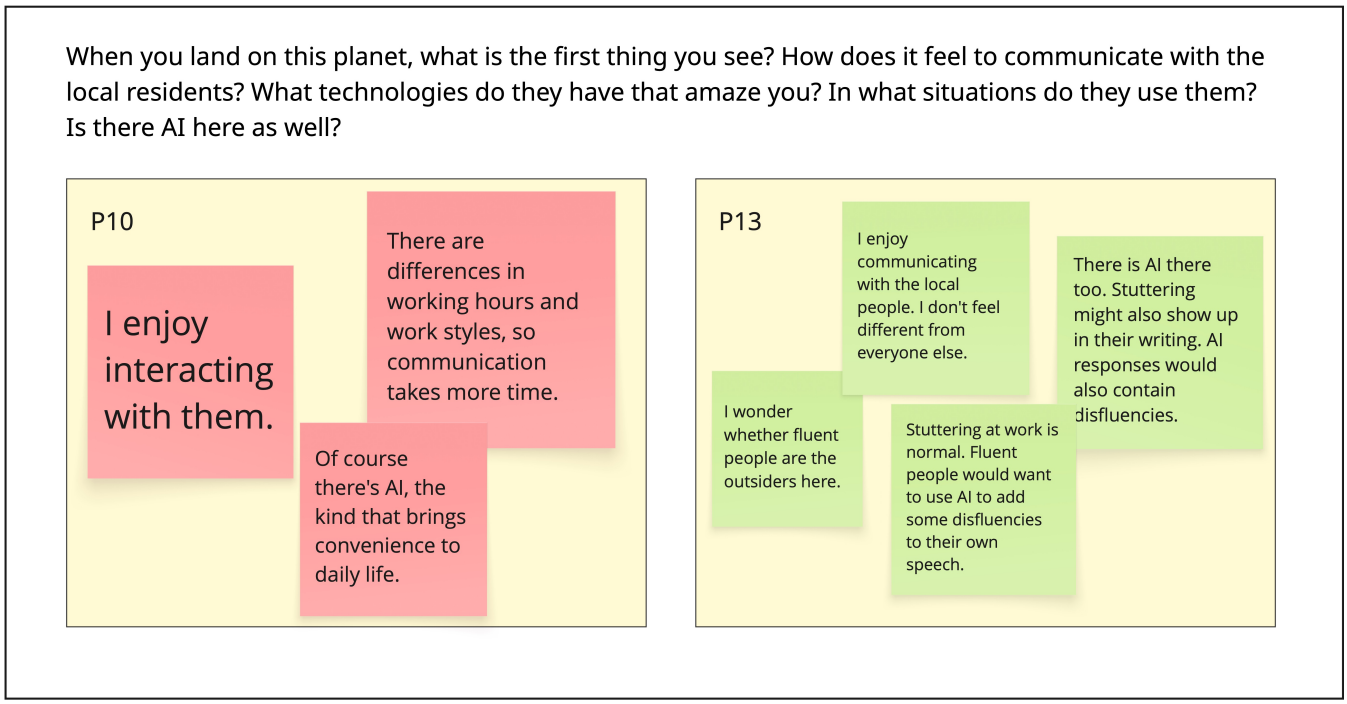


Figure 3: Sample responses to the Stuttering Planet prompt on the shared Miro board from P10 and P13, translated from Mandarin.

analysis of the data collected. All five researchers independently reviewed the translated transcripts from the first two workshops and generated preliminary codes around participants' expressed values, stuttering experiences, and design ideas. These initial codes were discussed collaboratively to compare interpretations and develop a shared coding framework. Building on this shared foundation, the first author led the analysis of the subsequent workshops, with emerging themes shared and refined in regular research meetings. As coding progressed, we moved into the axial coding phase [21], linking categories and subcategories around key dimensions. Emerging categories were integrated into broader themes through collective review and discussion. These final themes informed our interpretation of how participants negotiated fluency, time, and accessibility in imagining inclusive speech AI technologies.

3.3 Positionality Statement

We acknowledge that our personal backgrounds and identities shape how we engage with stuttering communities and interpret

our findings. Three members of the research team are Mandarin-speaking and currently reside outside mainland China. One identifies as a person who stutters, has strong personal and professional ties to the Chinese stuttering community, and contributes essential insider perspectives throughout the research process. Our language and disability backgrounds enabled trust-building and culturally grounded communication throughout the study. We also recognize that our socioeconomic and educational background may have shaped power dynamics, participants' willingness to share personal experiences. We engaged reflexively throughout.

4 FINDINGS

Participants articulated independence, acceptance, and well-being, alongside critiques of speech technologies that enforce narrow expectations of fluency and speed. However, when they designed for their present lives, they envisioned tools that helped them function within fluency-centered systems rather than tools that reflected those values. When the same participants later imagined communication on a "Stuttering Planet" where stuttered speech was the norm, they began redesigning communication systems rather than adapting to them. We will present participants' values in Section 4.1, their present-world designs in Section 4.2, and the speculative designs they produced when the normative frame was displaced in Section 4.3.

4.1 Personal Values that Ground the Design Exercise

Across all workshops, participants first articulated the values that matter most to them in daily and professional life. This exercise enabled participants to identify core values that both exposed failures in existing communication systems and guided their design goals. Three values recurred consistently: Independence, Acceptance, and Well-being.

4.1.1 Independence and Agency. Participants consistently identified independence as a core value, but defined it as communicative autonomy rather than speech fluency. Independence did not mean speaking without stuttering, but meant participating in everyday and professional life without deferring, avoiding, or relying on others to speak on one's behalf. This definition shifts the problem from individual ability to system design: the deficit lies not in the speaker, but in the conditions of participation that communication systems create [6]. P3 described how the anticipation of stuttering had limited her agency in a routine interaction: *"I think 'independence' is really important, especially for PWS…Every time I wanted coffee, I had to ask my boyfriend to place the order for me…For PWS, independence means being able to speak when you want to, and not speak when you don't want to."* The barrier here is not speech production but social participation: rigid timing and verbal expectations transferred PWS's agency to someone else. The communication system did not accommodate their rhythm, so PWS had to accommodate its demands by withdrawing. In professional contexts, the cost was higher. P8 described routinely holding back opinions at work to avoid disfluency: *"To maintain fluency…I often hold back…the opinions I express don't fully represent my actual thoughts."* Independence here extends beyond action to self-expression—the capacity to represent one's own thinking fully and on one's own terms [1].

4.1.2 Acceptance and Equality. Participants drew an important distinction between self-acceptance and acceptance by others. P5 described acceptance as a long personal journey: *"Acceptance—that's something I really hadn't been able to do in the past…Over time, I came to deeply feel that stuttering is also a part of who we are."* However, this internal shift did not change the external conditions that produced shame. P9 articulated the remaining gap: *"There are certain societal expectations about how you should speak…And stuttering, in their view, falls outside of what is considered acceptable or 'normal' speech."* Prior HCI research has shown that the visibility of disability-related behavior shapes social evaluation independently of the user's self-perception, meaning users of assistive technologies must navigate how others interpret their behavior, not just how the technology works [74]. Participants argued that technology can reinforce these expectations. P10 observed current AI systems implicitly require PWS to perform as fluent speakers: *"If the AI still requires us to speak fluently—like, if we have to say something once, then twice, then three times—then it's basically expecting us to behave exactly like someone who doesn't stutter. There's no accommodation."* This expectation reflects a design choice about whose speech patterns systems treat as normal. Many technologies are designed around a biased assumption of a standard speaker [37].

4.1.3 Mental and Physical Well-being. Participants named well-being as a core value and described it as relief from the sustained psychological and physical effort of managing and monitoring their speech. For them, communication difficulty was closely tied to hypervigilance, psychological pressure, emotional exhaustion, and constant self-monitoring. P2 explained the effort of hiding stuttering: *"I never told the people around me that I stuttered. I just tried my best to hide it when speaking, like thinking of each word before saying it, doing everything I could not to stutter…it just felt like my brain was constantly tired."* This form of management, such as monitoring, anticipating, and suppressing, resembles what Hochschild [43] terms emotional labor: the effortful regulation of internal states to meet the expectations of a social situation. Harrington et al. [39] have noted the analogous burden, where marginalized users must perform self-management across systems not designed for them. In this context, the labor is not about performing a job but about trying to sound fluent, even though the cost of meeting this norm is often invisible to those who do it easily.

4.2 Speech Technologies for the Present: Designing Within Fluency Dominance

When asked to design technologies for their current lives, participants produced ideas that were practical and grounded in their daily experience. But a pattern emerged across all four workshops: their designs did not always match the values they had described earlier. For example, participants who had valued independence designed technologies that mediated or delegated their speech. Participants who had valued acceptance designed tools whose function was to produce fluent-sounding output. Participants who had highlighted well-being as relief from the labor of concealment designed systems that helped them hide it more effectively.

4.2.1 Efficiency as a Survival Requirement, Not a Speed Goal. Participants did not frame efficiency as being more productive. They

framed it as a requirement for participation: the minimum needed to complete everyday tasks without being excluded or penalized by systems that expect fluent, fast, and smooth speech. As participants described, the problem was not speaking slowly, but that communication systems treat slow speech as failure. P3 provided an example of using automated phone systems:

> For PWS, some tasks can be especially difficult. For instance, reading out a long phone number within 10 seconds can be very hard. It would help if systems offered options like 'I'd rather type than speak' or 'Choose 1: I'll speak at a regular pace; Choose 2: I stutter and need more time.' Even just one extra option could make customer service interactions much more supportive.

P3 calls for a different model of interaction, in which typing and slower speech are treated as equally valid ways of communication. As our survey showed (Section 3.1.3), such input failures and transcription errors were among the most commonly reported difficulties. These are not isolated errors, but systematic consequences of technical systems trained and designed for fluent speech.

P8 also envisioned a different approach: instead of requiring long, fluent speech, the system would reduce the amount of speaking needed,

> When I say 'I'm hungry,' the system could automatically recommend restaurants nearby or suggest food places…Ideally, I could customize certain commands, so that by saying just one short phrase, the AI could carry out a series of actions. If you only manage to say half a sentence, you could use the first half to suggest a few possible options.

P4 extended this to real-time conversation, where the cost of latency is higher: *"Typing manually just takes too long. If you're arguing with someone, they're not going to wait for you to convert your speech into text, and then wait again for the AI to transmit it back. The whole process is just too slow … there just isn't time otherwise."* This is not about wanting speed; it is about the asymmetry built into synchronous communication: fluent speakers can respond immediately, while PWS must either match that pace or risk exclusion. Wobbrock et al. [86] argued that performance-based interaction models systematically disadvantage users with motor or speech variability, not because those users cannot communicate, but because system design has defined their communication as error. However, participants' designs did not question this assumption. They focused on faster recognition, shorter required utterances, and more forgiving timing—all of which reduce the friction of fitting into existing systems rather than changing the system fundamentally.

4.2.2 Emotional Support as Accessibility Infrastructure. The psychological cost for PWS extended beyond the moment of disfluency. Participants described accumulating fatigue from constantly monitoring their speech, managing others' reactions, and maintaining composure in evaluative situations. In this context, participants treated emotional support itself as a form of accessibility that sustains confidence and well-being in a fluent world [39]. As P2 had described, the effort of concealment left him in a state where his *"brain was constantly tired."* Participants therefore imagined emotional support as a core feature of accessible technology, not an add-on. P9 described wanting a voice AI that could recognize when a day had been hard and respond accordingly: *"After a long day of speaking, when a person who stutters comes home feeling exhausted, a voice AI designed specifically for us could give positive feedback and encouragement. This kind of support would mean a lot."* P1 framed peer connection in similar terms: *"I want to find more people who also stutter … when I'm in a bad mood, or feeling a bit down, I can use a voice app to connect with some people like me. People I can talk to and share what's on my mind."* One survey respondent suggested AI systems that provide *"communication or therapeutic methods tailored specifically for people who stutter"* to help users rebuild confidence between high-pressure interactions (S4).

Some participants also emphasized high-stakes professional contexts, such as job interviews, workplace communication, and public speaking, where these pressures hit hardest. P13 described the workplace as the setting where how you speak could directly affect career opportunities and personal development: *"What affects me the most is the workplace. If I could speak fluently during meetings, when giving presentations, or during job interviews, and I don't have to worry about stuttering … that would be really helpful … but even in those jobs I could avoid speaking, communication is still needed, and there are still interviews."* P4 imagined wearable technology that could detect physiological stress and intervene: *"If it could detect things like your heart rate or stress level… if your heart rate becomes too fast, the system could guide you through a long-breathing technique to stabilize your speech. Or when you're feeling nervous, it might help you redirect your attention."* Previous research has argued that emotional labor and psychological burden are hidden costs of accessibility that conventional assistive technology tends to overlook, as systems focus on functional output while leaving the work of managing stigma to the user [39]. Participants' designs were an attempt to manage and share that work with the system rather than carry it alone. However, the underlying structure went unquestioned. The situations producing the pressure, such as timed interviews, meetings, and phone-based customer service, were treated as givens. Participants designed tools for getting through those situations rather than tools that might change them.

4.2.3 Autonomy Through Control. The most consistent design principle across present-world technologies was user-directed control: participants did not want AI to automatically correct or 'fluency-wash' their speech, but to give them options and wait for them to decide. Participants envisioned systems that could adapt to their current state and preferences rather than forcing them to fit rigid communication norms. P6 imagined a speech-to-text system that flagged potential disfluencies for review rather than silently removing them: *"I want the AI to notice if there are repetitions or unclear parts … It could say, 'This part might be unclear. Do you want to revise it?' That would give me the right to review and decide whether to change it, instead of the AI automatically fixing it."* P4 envisioned a toggle for repeated words in transcriptions: *"Maybe there could be a switch to turn this mode on or off."* The toggle does not specify what the system should do; it specifies when and under what conditions the system is allowed to act. In this sense, the design moves the decision from the model to the user.

At the same time, participants described wanting to delegate speech to AI entirely in situations where fluent speech felt too difficult to produce. Several participants envisioned AI systems that could temporarily speak on their behalf, assist them in producing speech, or manage the timing and clarity of their spoken output. P6 explained: *"If my boss says I have to do a presentation and speak a lot today, but I just happen to not feel like talking... So the key is that it should be my choice—whether or not I want the AI to speak for me."* Some participants designed technologies that intervened directly in the act of speaking. P2 proposed an earpiece that would convert his whisper into clear speech output: *"When I can't get the words out... it can help recognize it and output it... to avoid that awkward situation where people are waiting for me to speak, and I get stuck and can't say anything."* These proposals reflect what prior work has identified as shared autonomy, in which users retain decision-making power even when the system carries out the task on their behalf [29, 56]. These designs, taken together, reveal an internal tension. Participants who had named independence as their most important value were also designing technologies that mediated, delegated, or concealed their speech. These patterns suggest that when fluency-centered systems are taken as fixed, adaptive designs are the only kind available, even among participants who have explicitly critiqued the norms that environment enforces. Section 4.3 reports how these same participants designed differently when the communicative norm itself was displaced.

4.3 Speech Technologies for the Future: Unlocking Imagination Beyond Fluency

The Stuttering Planet activity was designed to do what the present-world task had not: remove fluency as the default and observe what participants would design when the underlying norms were open to redesign. We report the Stuttering Planet designs across three dimensions: the medium of communication, whose speech is treated as standard, and the temporal structures of interaction. In each dimension, participants questioned assumptions the present-world activity had taken as fixed. Table 3 places the two sets of designs side by side along these dimensions.

4.3.1 Redesigning the Medium: What Is Communication For? The most fundamental question the Stuttering Planet exercise produced was not how to improve speech technology but whether speech needed to be the primary channel of communication at all. When designing for the present world, every technology participant designed took spoken speech as the given channel and worked to reduce the cost of using it. On the Stuttering Planet, that assumption was no longer available, and participants' designs shifted accordingly. Several proposals did away with spoken speech entirely. P4 imagined brainwave-based communication: *"Maybe they've developed something like brain implants ... with sensors that pick up your thoughts and transmit them wirelessly for communication within society."* P11 made the underlying logic explicit: *"Spoken language would no longer be so important. Language is just a medium for expressing human thought. If a more advanced technology existed, then we wouldn't need to imitate human speech anymore."* What they describe is not a desire to communicate differently but a recognition that current speech technology asks PWS to perform fluency rather than simply to communicate.

Beyond removing speech altogether, participants also rethought communication as serving different purposes that each call for a different mode. P7 described two systems on the Stuttering Planet: a fast, thought-transmission channel for exchanging information and a slower, speech-based channel reserved for emotional expression, in which *"people might use pauses or prolongations to express emotional states."* In this framing, the properties of stuttered speech—its pauses, its repetitions, its variable rhythm—became tools for expression rather than failures. The pauses and repetitions that cause automated voice systems to time out, which participants in the present world had designed tools to conceal, became part of the expressive texture of communication on the Stuttering Planet. P6 extended this into aesthetics: *"Their music might also be disfluent—full of pauses, breaks, hesitations, and repetitions. Those elements would naturally be part of their musical style."* What participants were doing here was not imagining better assistive technology. They were taking features of their speech that the surrounding system had labeled as defects and reclassifying them as features. These designs represent a shift from remediation to revaluation [60], and this shift only became possible once the Stuttering Planet exercise had removed the assumption that fluent speech is the standard against which all communication should be measured.

4.3.2 Redesigning the Norm: Whose Speech Counts? Beyond the medium, participants also reversed who counts as a legitimate speaker. Rather than imagining better accommodations within the existing communicative norm, participants inverted it entirely. The inversions participants produced served to expose how social power, rather than any communicative necessity, determines whose speech is treated as normal. P9 envisioned a world in which fluent speakers had to conceal their fluency to conform: *"On this planet, people who speak fluently would actually need to hide it. They would have to deliberately add stuttering into their speech in order to fit in."* P10 named what this revealed: *"Those who didn't stutter would become the 'outsiders.' When they spoke fluently, the majority might mock them: 'Why do you talk so fluently?' It raises the question: Why should fluency be considered the only 'normal' way of speaking?"* This question could not have been asked directly in the present world because there it would have conflicted with the reality that fluency is the norm, whatever its origins. The speculative setting created the necessary distance to make the question askable. By placing participants on a planet where their speech was the standard, the exercise gave them a position from which to look back at the norm they always lived inside.

What the inversion made clear was the social mechanism behind stigma, and how communicative norms are embedded in technologies we use. P13 connected this inversion to the social origin of stigma: *"The harm caused by stuttering has always come from feeling different from others, being laughed at, or having people look at me strangely when I speak. But on that planet, none of that would exist ... maybe the people who are fluent there would be the ones who feel different from everyone else."* In this imagined world, the harm disappears because difference disappears, and because the communicative standard has shifted so that stuttered speech is no longer marked as deviant. In this account, stigma is not a response to disfluency itself but to the gap between disfluency and

Table 3: Comparison of participants' designs across the present-world activity (Section 4.2) and the Stuttering Planet activity (Section 4.3), organized by the three dimensions along which their designs shifted. When the fluency norm was held fixed, designs adapted individuals to existing systems; when it was displaced, the same participants redesigned the systems themselves.

Dimension	Present-world designs	Stuttering Planet designs
Medium	Speech is taken as the preferred medium for interaction; designs reduce the amount of speaking required rather than supporting other communication media, e.g., saying half a sentence and letting the system suggest completions (P8).	Whether speech must be the primary channel is itself questioned, e.g., brainwave/thought transmission (P4, P11); disfluent features such as pauses and repetitions are reframed as expressive resources (P7).
Norm	The fluency requirement is taken as given; designs aim to make the user sound fluent, e.g., an earpiece that converts a whisper into clear speech to avoid getting stuck while others wait (P2).	Fluency is no longer the standard: stigma towards stuttering is socially constructed rather than an inherent consequence of disfluency (P9, P10), AI trained on disfluent corpora no longer scores disfluency as error (P13).
Time	Temporal accessibility is addressed during individual interactions, e.g., an "I need more time" option for providing information verbally under a time limit (P3), or shortening what must be said by auto-completing half-utterances (P8).	Re-configuring institutional and temporal structures in society: longer time allotments for interviews and meetings (P10); flexible and context-sensitive pacing expectation—fast where time-sensitive, slow where it is not (P12, P5).

whatever has happened to be designated as normal. This logic extended into public culture. P7 described his first encounter with language on the Stuttering Planet: *"When I first stepped onto this planet, I immediately saw an advertisement that read, 'Sp-sp-sp-sp-space Exploration Journey.' … all advertisements were written in a stuttering style. They weren't simplified or made to look 'normal'."* P9 extended this into social status: *"If there were a planet entirely made up of people who stutter, then stuttering would actually become the admired, 'fluent' way of speaking … so there would be stuttering competitions, where the person who stutters the most would be considered the most attractive."* These accounts follow the inversion through to its conclusion—if stigma comes from the gap between one's speech and whatever has been designated as the aesthetic and communicative ideal, then changing that ideal will change everything downstream of it.

This observation on the origins of stigma extended to technology itself. P13 identified the specific way current AI systems reproduce norms: *"AI responses, whether spoken or written, might also be disfluent, because the entire language corpus would be based on stuttering."* By imagining a speech AI trained on disfluent speech, participants identified how current AI systems reproduce the speech patterns of whoever contributed to their training data and treat anything that deviates from those patterns as an error [55, 85]. The problem is not only that AI fails to recognize stuttered speech, but also that AI systems have been built to optimize for a norm that excludes it. The Stuttering Planet exercise made this structural fact visible and open to critique.

4.3.3 Redesigning Time: When Does Communication Happen? When designing for present needs, participants had identified time as the main source of exclusion, but their designs had addressed time only at the level of individual interaction. The larger temporal structures that produced those constraints were still left untouched. On the Stuttering Planet, rather than asking how individuals could communicate faster, participants asked how institutions and systems could be organized to make room for different temporal rhythms. P10 described how interview and meeting formats would change: *"On Earth, you might be given five minutes to introduce yourself, but on that planet, maybe they'd give you ten or even twenty minutes … Their work patterns and schedules would certainly be different … Time would definitely work differently there."* P13 went further, questioning the assumption that synchronous communication should be the dominant mode: *"Maybe on that planet, there wouldn't be so many meetings, and people would use other ways to communicate information … They might invent more text-based or alternative technologies of interaction. And then efficiency wouldn't be an issue."* They are not asking for more time within the existing format, but questioning why the format that most disadvantages them is treated as the default. This also connects to the well-being value participants had named and specifically to the cognitive and emotional labor of concealment. The fatigue was a direct consequence of temporal norms: if taking more time carried no penalty, there would be less reason to suppress.

Importantly, participants did not propose a uniformly slower world. P12 resisted that reading:

> I wouldn't want that planet to be entirely made up of people who stutter. Because we do speak more slowly, the pace isn't as fast … In emergencies, like a fire or someone needing first aid, if everything operated at that slower pace, it could seriously affect how urgent situations are handled. It could even become a kind of disaster.

P5 articulated the principle this produced: *"If in a meeting, no one has anything else scheduled afterward, then we can stutter as much as we want, and everyone understands … So I think it depends on*

whether the situation is time-sensitive." These accounts do not ask for slowness to universally replace speed. They ask for temporal flexibility to be built into systems as a design property, so that systems can shift between interaction speeds depending on context instead of imposing a single pace on all users in all situations. We do not claim that the Stuttering Planet scenario was the only way to produce this shift, nor that this contrast alone establishes a causal mechanism. For participants who had lived within systems that treated their speech as deficient, designing outside of those systems was not easy. What the speculative activity appeared to offer was new realms for imagination—however temporary, and however specific to the workshop context—that the present-world activity had not produced.

5 DISCUSSION

5.1 The Value-Design Gap: Internalized Norms as Constraints to Design Imagination

In the opening workshop activity, participants articulated independence, acceptance, and well-being as core values. However, the tools they designed for their present lives—earpieces that convert whispers into fluent speech, or AI systems that spoke on their behalf—mainly reduced the cost of not conforming to fluency-centered systems rather than challenging those systems themselves. This gap reflects a broader pattern in accessibility design, where participatory methods can reproduce dominant assumptions when those assumptions remain unexamined [7, 22, 38]. Writing more broadly about oppression and consciousness, Freire [31] argued that sustained subjugation produces a condition in which the marginalized internalize the image of themselves held by dominant groups, making it difficult to envision alternatives from within the same frame that constrained them. Our findings provide an empirical instance of this pattern: participants are designing for a world they know will evaluate them by fluency, and their proposals respond to that constraint. This is not a failure of creativity, but a reflection of how deeply these norms are built into everyday systems. This extends what Shinohara et al. [72] call social accessibility, the idea that assistive technologies are judged not only by whether they function, but by how they make users appear to others. Our findings show the same concern; at the moment of design, participants anticipated being evaluated by fluency and so proposed tools that would make them appear fluent, before any technology was used. Social accessibility thus constrains not only how technologies are used, but what users feel able to imagine designing.

Seen in this light, fluency dominance operates not only at the level of system design, but also at the level of design imagination. It shapes what participants treat as feasible or worth proposing. This raises a methodological challenge for accessibility research. If sustained stigma shapes what oppressed communities can reasonably imagine, then including participation in the process is not enough to surface alternative designs. Imagination must be actively supported. Prior work in feminist and disability communities has argued that freeing imagination requires sustained collective work to name the conditions one has been living within, often before alternatives become thinkable [31, 46]. Similarly, work in crip technoscience treats access as something achieved collectively, through practices that make different futures feel possible [37]. Our findings align with this perspective. They suggest that accessibility research must attend not only to who participates, but also to how design processes are structured. Without deliberate efforts to surface and unsettle dominant norms, participatory design is likely to reproduce them. Opening space for alternative designs may therefore require methods that explicitly change what the task treats as given and what it treats as open to change.

5.2 Speculative Design as an Intervention

While the previous section identifies a gap between participants' values and their designs, the question remains how that gap can be addressed in practice. Our findings suggest that what mattered was not speculative design as such, but a more general methodological lever it provided: changing the conditions in which participants make design decisions, specifically, what the task treats as fixed versus open to redesign. Speculative design was the means by which we displaced the fluency norm, but the lever is the framing of the task itself. Prior work in speculative and critical design has argued that such methods surface and challenge assumptions embedded in existing sociotechnical systems [79, 82]. In HCI, this has been described variously as defamiliarizing the taken-for-granted [5], deliberately violating the everyday expectations that make current technologies feel normal [23], or constructing futures by holding some elements fixed while varying others [88]. Our findings extend this account to the participant level by showing a more specific mechanism: within a concrete design task, speculative scenarios change what participants treat as fixed versus negotiable. This also distinguishes our work from the imagined-world of *Eyeth* [2], where researchers relocated participants to a fictional world as the site of inquiry itself; we instead compare the designs participants produced within the Stuttering Planet scenario against those they produced for the present-world, and interpret the difference as evidence of how task framing shapes what participants design. Our participants' present-world designs are consistent with prior observations that users tend to adapt to dominant infrastructures rather than challenge them, especially when those infrastructures are experienced as stable and unavoidable [22, 38]. In this sense, the design space was already constrained by these assumptions before participants began designing.

This points to something the accessibility research community has been discussing in other forms. Recent ASSETS work has argued that our field should learn more from critical disability studies [44, 60]. Most of that conversation has been about who we include in research and how we work with them. Our findings add a different question: what does the design task itself treat as open to change? Including disabled participants is necessary, but it does not automatically mean the dominant norm is questioned or reconsidered. In our study, participants could question fluency norms only after the activity provided a setting in which those norms were no longer treated as given. This has a practical implication for other accessibility researchers. When a participatory study produces designs that adapt to existing systems rather than challenge them, it is worth asking whether the activity itself presented the existing system as fixed or unchangeable. If it did, adaptive designs may reflect limitations of the study design, not the limits of what participants could imagine. What transfers is not the "planet"

scenario itself but the underlying move: identifying the dominant norm that governs a design space and framing the task so that the norm becomes open to questioning. We see potential for such moves in other speech-related research, in accessibility work with other communities shaped by sustained stigma, and in non-speech domains where a deeply naturalized norm similarly narrows what participants treat as changeable.

5.3 From Individual Adaptation to Infrastructural Redesign in Speech Accessibility

Once participants were freed from designing within fluency-centered systems, the designs they produced pointed to something specific about what those systems impose. They did not propose better recognition, faster endpointing, or smarter wake words. They redesigned the conditions that determine when, how quickly, and under what constraints speech must occur. The core constraint in current speech technology is not recognition accuracy but a temporal assumption built into interaction timing, turn-taking, and system responsiveness: that communication happens at a fluent pace. Fluency, in the participants' accounts, was a temporal norm as much as a linguistic one. To speak fluently meant to speak at an expected pace, to respond within an expected window, and to maintain the rhythm of synchronous exchange without pauses long enough to be interpreted as a breakdown. When participants described the difficulty of their daily communication, they described difficulty conforming to these temporal expectations, not difficulty producing speech as such.

This finding gives a concrete mechanism to a long-standing theoretical position. Disability studies and HCI have long argued that disability is produced through the interaction between bodies and environments rather than residing in individuals [6, 62, 70, 74]. Yet many speech technologies continue to operate within an individual-centered paradigm, treating disfluency as something to be recognized, corrected, or worked around. Chrononormativity has largely been analyzed at the level of institutions, such as schedules, deadlines, and life-course milestones [30]. In speech technology, it is literally encoded as design parameters, rendering normative pace as configurable constants. The disabling condition is not disfluency but the system-level penalties triggered when speech does not match expected timing. Kafer [50] describes crip time as bending the clock to meet disabled bodies and minds, rather than bending bodies to meet the clock. Participants articulated how that bending should operate: not a uniformly slower world, but pacing that flexes by context—flexibility, not mere extension, as the design property.

Hamraie [36] argues that access should be understood as a collective and infrastructural condition, embedded in the design of environments rather than added as an afterthought. Participants' Stuttering Planet designs (Table 3, right column) outline what such an infrastructure could look like in speech technology, one in which speed and immediacy are no longer unquestioned defaults. Interaction does not assume synchronous exchange. Input channels tolerate partial and multimodal contributions, models are trained on disfluent corpora, and emotional support is treated as part of what a communication system provides, because the fatigue of managing one's pace is itself a cost imposed by current timing expectations.

This is a horizon rather than an immediate roadmap: a full reorganization of communication infrastructure around stuttered speech is not something any single system can deliver, and improving existing mechanisms along current lines retains value, though it leaves the temporal assumption intact. Each dimension of Table 3, however, suggests a near-term move that shifts where the cost falls—from users absorbing the cost of a fluency-centered system to the system changing its own properties. These are design directions our probe surfaced, not systems we built or evaluated. On time, endpointing and turn-taking need not be made faster but flexible: adjustable silence thresholds, user-signaled turn completion, or an explicit "I need more time" path through automated services (P3). On the medium dimension, partial and multimodal input can be treated as valid rather than as failure, with half-utterances recognized and completion options offered (P8). On the norm dimension, recognition can be trained and evaluated on disfluency-inclusive corpora so that repetitions and prolongations are not scored as errors (P13), and disfluency is flagged for user review rather than silently removed (P4, P6).

6 LIMITATIONS AND FUTURE WORK

Several constraints on this study warrant consideration. Participants skew toward educated adults aged 25–34 recruited through an online stuttering advocacy organization. This reflects a pattern common to community-recruited online research—people who are active in organized advocacy communities, and are comfortable using digital platforms to communicate and participate in studies. Older adults, people with severe stuttering who avoid digital communication contexts, those without advocacy community access, and those in rural or lower-resource settings are likely underrepresented. In our survey, 66% of respondents identified as men, which broadly reflects the epidemiological distribution of stuttering: population studies consistently find that stuttering affects men at approximately three to four times the rate of women in adulthood, a ratio that widens from childhood through adolescence [25, 91]. Our data cannot adequately address how fluency norms are experienced differently across genders, which is a gap that future work should address. In addition, all workshops were conducted in Mandarin Chinese and translated into English for analysis. Translation is not a neutral process: idiomatic expressions, culturally specific references, and the affective register of speech are not fully preserved in translation [78]. We mitigated this through a team translation process in which Mandarin-speaking researchers both translated and reviewed translations to check accuracy and preserve intended meaning. Participant quotes presented in this paper are translated renderings.

This study highlights that temporal norms are not culturally neutral. Prior research has shown that East Asian communication contexts often place strong emphasis on evaluation, discipline, and conformity to social expectations, particularly in high-stakes environments such as interviews and formal interactions [45]. This may intensify the pressures our participants described compared to other cultural contexts, and it may also affect what speculative design scenarios can accomplish—for example, how much change

to the setting is needed to shift participants' assumptions, and what kinds of alternative scenarios feel plausible or meaningful. Our finding that a futures-oriented prompt was insufficient to break from internalized fluency norms, while the Stuttering Planet scenario was not, may reflect something specific about this context rather than a universal feature of speculative design with stigmatized communities. Comparative work across cultural settings would help us understand these factors and assess how speculative design methods need to be adapted across different cultural contexts of stigma. Such work would also address a broader gap: most research on stuttering, accessibility, and communication technology has been conducted in Western contexts, and the extent to which those findings generalize to other contexts remains unclear.

7 CONCLUSION

This paper asked how people who stutter experience and reimagine speech-based communication systems structured around fluent and time-sensitive interaction. Our findings describe a gap. When we first asked participants to design for their present lives, their ideas remained within those structures even when they had critiqued them. When the same participants were invited to imagine communication on a Stuttering Planet where fluent speech was no longer the default, they produced designs that questioned how communication should happen, who is recognized as a legitimate speaker, and how interaction is paced over time. The change was not produced by a change in who was designing or what they valued. It was produced by a change in what parts of the system were treated as fixed versus open to redesign within the task. Our findings reframe accessibility in speech technology not as a problem of fitting users more successfully into existing interaction structures but as a question about whether those interaction structures should be redesigned in the first place. The same reframing also applies to participatory design practice. When communities have lived within systems that treat their bodies or voices as deficient, asking what they need will tend to produce adaptations to those systems. Producing structural critique requires methods that explicitly allow participants to question and redesign those systems, rather than take them as given. Such methods deserve more attention than they currently receive.

Acknowledgments

This work was supported by National Science Foundation Award No. 2427710 and the Patrick J. McGovern Foundation. Our deepest thanks go to the people who stutter who took part in this study. They trusted us with their frustrations, their daily workarounds, and their imaginations of a different world. We are also grateful to StammerTalk, whose help with recruitment and whose ongoing work alongside the Chinese stuttering community made this research possible.

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