Contamination, Otherness, and Negotiating Bottom-Up Sociotechnical Imaginaries in Participatory Speculative Design

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ABSTRACT

Participatory Design scholars and practitioners have embraced speculative design approaches to challenge normative assumptions about sociotechnical futures and address the systemic lack of racial and class diversity in futuring. This paper draws upon a community-based participatory speculative design (PSD) project conducted with a group of working-class Detroiters, focusing on speculating about alternative community economies. We illustrate how PSD served as a process of ongoing "contamination" where the boundaries of community members' visions of desired futures are opened up, troubled, and negotiated on the individual, alliance, and collective levels, thus forming new commons for collaboration and resistance across differences. For them, such contamination was a reflexive process aimed at identifying whose visions were excluded from their own and how community-held sociotechnical imaginary could emerge through collaboration. We argue that foregrounding contamination in PSD makes meaningful space for fostering reflexivity in knowledge production, while destabilizing and reassembling more inclusive sociotechnical futures.

CCS CONCEPTS

• **Human-centered computing** → **Participatory design**.

KEYWORDS

contamination; sociotechnical imaginaries; participatory speculative design; collaboration; community-based participatory research

1 INTRODUCTION

Participatory Design (PD) scholarship has long focused on promoting participation and democracy by engaging the public in the design process of addressing challenges arising from or in response to problems experienced in the situation [1, 20]. In the meantime, there is a growing interest in design communities in exploring the

implications of emerging and future technical artifacts and scenarios with potential users. However, engagements in speculation and speculative scenarios often stem from traditional expert knowledge and have been criticized for lacking reflexivity [28, 45], being removed from the lived experiences of the most affected communities [28, 54], and failing to involve these communities in the speculative process [30, 69]. Against this backdrop, speculative designers have increasingly embraced the participatory turn, actively involving non-designers and minoritized communities in the process of envisioning preferable future sociotechnical worlds [25, 39].

Participatory Speculative Design (PSD), as a platform and approach for "social dreaming together," thus serves as a powerful tool to center impacted communities' expertise and knowledge in articulating sociotechnical alternatives, with the goal of challenging present societal norms [25]. These alternative visions often raise critical questions about how futures are initially established, how large-scale sociotechnical imaginaries are naturalized by powerful actors like nation-states and capitalist markets, and how to promote viable alternatives outside the dominant visions of technoscientific progress [42, 44, 65]. If large-scale sociotechnical imaginaries are "collectively imagined forms of social life and social order reflected in the design and fulfillment of nation-specific scientific and/or technological projects" [41, p.120], PSD approaches present meaningful methodological frameworks to produce bottom-up imaginaries as viable alternatives. These community-held imaginaries will have the potential to not only challenge large-scale imaginaries from the margins but also inform collaborative infrastructure development to enact preferable forms and order of sociality [46, 68, 73].

Therefore, in this article, we attend to the making of bottom-up sociotechnical imaginaries in the PSD space. That is, unlike most PSD studies that primarily explore the cultural meanings and impacts of alternative visions for future sociotechnical worlds, we pivot our analytical focus towards understanding the intricate process through which bottom-up sociotechnical imaginaries are negotiated, temporally stabilized and ultimately embraced and acted upon collectively. And more importantly, we examine what we can learn from this process. To achieve this, we extend an analysis of a PSD project conducted with a group of working-class Detroiters in collaboration with an activist community organization dedicated to advocating for economic and political justice among Black and brown Detroiters [18]. In this project, we organized a five-week online workshop series, inviting community members to elicit alternative community economies, ones that move beyond capitalist exploitation and racialized dispossession.

By tracing the individual histories of each participant, understanding how they came to interact and relate to one another, and observing the shifts in their relations during their engagement in PSD activities, this article teases out how community members and

their visions of desired futures were *contaminated* with one another. Contamination, as defined by feminist STS scholar Anna Tsing, is a process through which previously separate and stand-alone entities become entangled and co-constitutive [70]. As a process involving collaboration amidst precarity, contamination offers an entry point to understanding the formation of sociotechnical imaginaries in heterogeneous and marginalized communities. Attending to the contamination taking place in our PSD workshops, even though fostering contamination was not one of their original aims, allows us to demonstrate how individual visions of desired futures are opened up, disrupted, negotiated, and then (re)articulated, allowing for an expansion of one's situated vision to the otherness. We illustrate how this often uneasy and sometimes risky process of contamination facilitates becoming common and, in turn, the generation of an actionable sociotechnical imaginary within the community. As we will see later, contamination renders PSD a meaningful tool for resisting ontological segregation, critiquing epistemological abstraction, and subverting political domination both at the present and as a trajectory toward possible alternatives.

Together, we propose advancing the concept of contamination—alongside its dimensions of *encountering others*, *recognizing partiality*, *experiencing self-other transformation*, and *articulating new alliances*—as an analytical lens in PSD work, which offers insights into how PSD disrupts institutionalized sociotechnical imaginaries through weaving together the alternatives the grassroots level. In this light, it is precisely the contamination process during PSD that articulates new connections beyond differences and fosters collaborations from these gatherings across various temporalities—facilitating what we might term "connecting beyond participation."

2 RELATED WORK

We position our work within Science and Technology Studies (STS), focusing on the concepts of sociotechnical imaginaries and contamination. We also draw from the literature on PD and Human-Computer Interaction (HCI), particularly looking into the generative role of PSD in promoting participation and diversity.

2.1 Sociotechnical Imaginaries

Building on Michel Callon [13] among others, Jasanoff and Kim used the term "sociotechnical imaginaries" to describe the process in which scientific representations and technical development are both shaping and shaped by "collectively held, institutionally stabilized, and publicly performed visions of desirable futures" [41, p.6]. This is to say, scientific and technical projects shape our future visions by creating ideas about how society should be. Such projects enact and naturalize particular forms and order of sociality [65]. In this sense, sociotechnical imaginaries must thus be understood as both descriptive and prescriptive, meaning that they tell us what we *should do* by guiding our actions and decisions. They produce the structures of meaning, materiality, and morality that their articulation reveals.

While Jasanoff and Kim's original formulation of sociotechnical imaginaries focuses on state-led projects of imagining, this definition has since been broadened to incorporate the imaginaries of non-state collective institutions, including corporations, social movements, and professional societies [42]. In some cases, these

non-state actors have come to play a larger role in shaping sociotechnical visions of the future than the nation-states that were originally considered responsible for their existence [40, 60]. That is, rather than being produced by consensus via one institution, sociotechnical imaginaries are actually subject to negotiation by varied collective actors who may compete to assert the dominance of their respective visions of the future at the expense of collectives at the margins [53]. Furthermore, sociotechnical imaginaries are contested not only at the level of large-scale technical and scientific development but also at the grassroots level of individual and communal imagination [46, 52]. The process of their production thus has a temporal element as well as a relational one, requiring a sustained and escalating *process* of negotiation among actors before the widespread adoption of what can truly be considered an "imaginary."

Our paper attends to this process of negotiation taken place in a series of PSD workshops where a group of community members speculated alternative community economies. In doing so, our work contributes to the scholarship on sociotechnical imaginaries in two ways. First, we demonstrate how PSD can function as a generative space, giving rise to alternative possibilities that disrupt and decenter the prevailing large-scale imaginaries dominated by institutions and markets. Second, we show the making of bottom-up sociotechnical imaginaries within grassroots and minoritized communities as a never-ending process of "contamination," a concept we elaborate on in the following section. This process of contamination makes space for forging new alliances across differences, serving as a site for fostering solidarity and political power in the present.

2.2 Contamination and Contaminated Diversity

In *Mushroom at the End of the World* [70], feminist STS scholar Anna Tsing traces the moving of matsutake mushrooms within the transnational sociotechnical assemblages to examine how they continue to survive at the capitalist ruins amidst environmental and human disturbances. She observes that it is the ongoing contamination and adaptation that makes it possible for collective survival amidst precarity. In Tsing's words, "We are contaminated by our encounters; they change who we are as we make way for others" [70, p.27]. That is, contamination involves transformation through encounters, embracing vulnerability with others, and thereby fostering collaboration across differences. Contamination is never-ending and makes diversity—"contaminated diversity" in Tsing's words—and without these collaborations, "we all die" [70, p.28].

Contamination, therefore, offers a conceptual tool to make sense of our transformative encounters and relations with surrounding humans/non-humans/things, our dependence and vulnerability to these relations, and our inevitable need for collaborating with others. This relational and material turn is largely informed by feminist theorists such as Donna Haraway [34, 35], Annemarie Mol [56], Karen Barad [2], and more who foreground relation, entanglement, and material at the forefront of understanding the world. It also closely aligns with Black Feminist liberatory work that envisions alternative knowledge practices and advocates for multiple and diverse ways of living and knowing because our collective existence is deeply entangled with shared vulnerabilities, families, communities, and ecosystems [5, 11, 55]. In other words, the notion of

contamination challenges modernist and rationalist promises of self-containment, predictability, and scalability [70].

In this way, contamination can serve as a useful concept to illuminate the articulation of bottom-up sociotechnical imaginaries. Whereas unitary state-led or corporate imaginaries—which tend to be produced from positions of political and/or economic power [53]—have already been made legible by existing scholarship, the imaginaries of heterogeneous communities located at the margins often escape analysis centered around nodes of power. Contamination, with its focus on interrelation and adaptation amidst conditions of precarity, enables us to understand the escalating processes of negotiation among actors whose visions are not produced from a position of unitary power.

Given the call for reflexive and relational turn in PD and HCI (e.g., [1, 3, 6, 19, 23, 24, 51]) and the potential to bring people together through the design approaches we use, might there be opportunities for contamination within our approaches? Our article explores how the bottom-up generation of sociotechnical imaginaries among community members at the margins involves contamination through PSD. How are boundaries of desired futures opened up and reassembled in these participatory spaces, and how do community members articulate collective visions through collaboration and active reflection on who is left out?

2.3 Promoting Participation and Diversity through Participatory Speculative Design

The goal of speculative design is to "open up all sorts of possibilities that can be discussed, debated, and used to collectively define a preferable future for a given group of people" [22, p.30]. In response to the critique regarding the lack of engagement with impacted communities and their living experiences in speculative design [28, 30, 45], scholars in PD and HCI have begun to extend PD's role in promoting participation and diversity in speculative design by engaging Afrofuturist, feminist, and decolonial theories [20, 39]. For example, prior HCI research has demonstrated how PSD approaches can offer new entry points to teasing out the complexity of social phenomenon and imagining alternative futures that challenge present oppressive norms [3, 4, 8, 9, 37]. This creates space for diverse perspectives and values and shifts power from expert designers and technologists as the decision-makers toward impacted communities of potential beneficiaries of technology. PSD allows for different perspectives and consideration of unintended consequences for different social groups [8]. For example, Harrington and Dillahunt [37] employed a PSD approach by conducting remote co-design sessions with Black Chicago youth to envision utopian and dystopian futures. While cultural hegemony prevented the youth from imagining radical futures that transcend existing power structures, these authors showed that centering Afrofuturism with PSD allowed them to see themselves in the future.

Indeed, to promote participation, PSD engagements do not necessarily orient toward designing or evaluating new technical artifacts [20]. Instead, these engagements could grapple with unequal sociotechnical conditions of design, foreground dominant power arrangements in which these conditions are embedded, and, more importantly, disrupt the unquestioned industrial and technological progress and more conventional pre-determined singular futures

[47, 66]. To achieve this goal, we see an opportunity to bridge the concept of sociotechnical imaginaries with a commitment to PSD. To be sure, a growing body of PD and HCI work has explored how speculative design enables designers to contest and foster alternative sociotechnical imaginaries [15, 20, 65, 67]. For example, in exploring "infrastructural speculation," Wong and colleagues urge speculative designers to grapple with infrastructural legacies of historical large-scale sociotechnical imaginaries [73]. Through the infrastructural lens, these authors emphasize the importance of attending to the historical lineages propagated through dominant imaginaries and their formation and maintenance of everyday infrastructures [73]. Along this vein, we are interested in how PSD can serve as a participatory space to disrupt the large-scale sociotechnical imaginaries shaped by institutions and markets and to allow for the emergence and articulation of community-held sociotechnical imaginaries that impacted communities can act upon. Building on the ongoing discussion of speculative design in PD and the methodological reflections on PSD (e.g., [3, 15, 28, 30, 38, 49, 50]), our work offers empirical insights and theoretical interventions on the emergence, negotiation, and coproduction of collective bottom-up sociotechnical imaginaries through PSD. By zooming into the contamination of these imaginaries in the PSD space, we show how this process is inherently relational and has the potential to forge new alliances and collaborations within impacted communities.

3 METHODS

Following a community-based participatory research (CBPR) approach, the university team partnered with a community-based organization (CO) in the city of Detroit. As a symbol of American modernity and deindustrialization, Detroit has been declining economically for many years due to the collapse of its automotive industry, politics, racial segregation, and white flight. In the meantime, Detroit has a rich history of Black liberation and grassroots movements. CO is a grassroots organization that works to build power and capacity for working-class Detroiters of color who are experiencing institutional marginalization both politically and economically. Rooted in abolitionist politics, the CO puts ongoing effort in neighborhood- and community-based organizing to tackle systematic oppression and exploitation in civic engagement, employment, healthcare, education, housing, and more. This research effort was part of a broader collaboration between the university researchers and CO to imagine and build alternative economic futures.

3.1 Community Partnership and Participant Recruitment

The partnership between the university team and the CO emerged from a fortunate set of coincidences. During a 2021 pre-inauguration event at the beginning of the country's political transition, the community organization spearheaded an envisioning session rooted in community engagement. One of the authors was in attendance and approached the community organization for a potential collaboration, given their similar goals of envisioning futures. The author outlined their objectives, emphasizing the mutual benefits and the aim to understand the community's vision. We were candid about the research scope and the roles we hoped the community

organization could play in aiding recruitment and co-facilitating sessions. We asked the CO for the cost to cover staff support to aid in recruitment and facilitation and to compensate community members for their time.

After finalizing the agreement, we sent the CO our recruitment flyer expressing our partnership and collaboration on a "participatory design project on speculating alternative economic systems," and inviting CO members to "take on the role of designers to collaboratively document design fictions and create digital artifacts that communicate narratives to imagine new models for employment, economic development, and growth to support the future of 'community' in Detroit." The flyer included the length of the 5-week online co-design workshops and compensation. The CO advertised the workshops to their constituents on our behalf and shared that they sent emails to those who they knew were interested in imagining a new economy and a separate announcement to their active member base.[1]

In total, 24 community members participated in the workshop series, while 17 participated in at least three workshops. For context, with a Black population of 78%, Detroit is one of the largest Black-majority cities in the U.S. [12]. Thus, most of the study participants were Black or African American (n=13). Out of those who reported their household annual income, most (n=9) reported earning less than $30K; three reported earning $30K-$49,999, and three reported earnings of $50K or more. Most participants were women (n=14), and the average age was 45.2 (Std dev=18.9). Despite the varied demographic backgrounds among participants, they, alongside the CO, shared a common abolitionist vision of building political power. While participants held a shared vision, they were not bound by it, meaning they remained flexible and open to adapting their strategies and methods to achieve their shared vision.

3.2 Co-organizing the PSD Workshops

University researchers and members of the CO worked collectively to create an open discussion space for diverse perspectives and voices, where everyone could be vulnerable and have fun. The team met a week beforehand to review, discuss, and plan the next week's session. We collectively brainstormed ways to make the online session inclusive, such as providing prompts in the chat, using polling functions, creating small breakout groups, assigning roles in each group (i.e., facilitator, note taker, timekeeper, presenter), and creating invitations for community participants to participate and engage. Examples of invitations for engagement included, "There are no 'right' or 'wrong' answers," "Share responsibility for including all voices in the conversation," and "Have fun!" We invited community participants to add other invitations for engagement at any point during the PSD process, which resulted in the addition of "Principled Struggle" after workshop 3.[2] We invited community participants to complete an anonymous feedback survey to respond to the three questions: "What did I love, What did I learn, and What

did I long for?" [3] We synthesized and shared responses at the beginning of the following week's session, adapting each week based on feedback. Research team members also held office hours each week to answer community participants' questions.

3.3 Researcher Positionality

We, the authors, bring a rich tapestry of perspectives shaped by a diverse range of races, ethnicities, genders, nationalities, socioeconomic backgrounds, and personal experiences. Two of us hold advanced university degrees, and one is currently an undergraduate at a prestigious university. We are acutely aware of the privileges that often accompany academic achievements. However, we also critically understand that in the United States, such privileges are not uniformly experienced and often do not translate into equitable benefits, particularly for racialized minorities [14, 17, 57]. This consciousness shapes our research approaches and analyses, compelling us to critically examine and challenge systemic inequities through our work.

3.4 Participatory Speculative Design Workshops

The university and community teams conducted a series of online PSD workshops with community members, which spanned five weeks from August to September 2021. Each workshop lasted two hours and was conducted online, adhering to COVID-19 health safety guidelines. The workshops were set for communities to envision alternative economic models based on community values, assets, and strengths. To facilitate our speculative design workshops, we adopted and adapted the "Building Utopias" toolkit that consisted of a workbook and card decks [8, 10].[4]

In particular, the first two weeks of the workshop set the foundation for participants to explore and envision alternative economies while considering the role of technology in shaping these futures. The workshop engaged participants in creative and speculative thinking to map out community values and legacies, while articulating personal visions of futures. The final three weeks of the workshop aimed to harness participants' collective creativity and insights to envision and design alternative digital economies while considering the strengths and values of the community. These weeks encouraged collaboration, discussion, and reflection on how technology might play a role in shaping more inclusive alternatives. The final week's session re-capped the prior four weeks and created a space for community participants to share their reflections, ways to work toward their imagined futures, and tools needed to get there. The Appendix A includes a detailed overview of each week's workshop activities.

3.5 Follow-up Interviews

After group workshops, we reached out to participants for in-depth follow-up interviews that aimed to dive deep into their experiences of participating in the PSD workshops and reflect on their own takeaways from this project. We began each interview with a set of warm-up questions asking community participants to tell us more about themselves (i.e., how long they have been living in Detroit

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[1]Active members have consistently attended in-person meetings/events over the past six months, has helped with organizational recruitment, are active in campaigns and pay membership dues.
[2]Principled Struggle is seen as "When we are struggling for the sake of something larger than ourselves and are honest and direct with each other while holding compassion" [11].

[3]These questions were adopted and modified the 4L's activity [31], which invites reflection on projects. We removed "Lacked" from the original activity.
[4]See https://www.buildingutopiadeck.com/ for details of the Building Utopias deck.

and a part of the CO, how they learned about the workshop), to recap their workshop experience and reflect on ways to improve in the future, and unpacking some of their workshop materials. We were able to conduct follow-up interviews with six participants in October 2021. These interviews were semi-structured, lasted one hour on average, and were conducted by the first author over Zoom.

3.6 Data Analysis

We drew on situational analysis [16], a postmodern approach to grounded theory, to iteratively analyze varied data generated from our PSD workshops and follow-up interviews, including workshop and interview transcripts, Zoom chat transcripts from the workshops, observation notes taken during the workshops, and the research team's reflection notes taken during the debrief meetings. The first author, the last author, and an undergraduate research assistant first open-coded the transcripts and other materials on NVivo and met regularly to review and discuss the generated themes and codes. Zooming into a subset of the salient initial themes, the first author then conducted another round of focused coding. During this process, the first and second authors met weekly to discuss and refine our interpretations of data and codes to develop the key themes presented in this paper, including "contaminating individual visions," "negotiating visions among alliances," and "weaving together collective sociotechnical imaginaries."

To demonstrate the nuances and complexities of these themes, we reviewed and identified salient moments during our PSD process that reflected each of these themes. Following the reporting method of thick description that is widely used in ethnographic writing and critical design scholarship [29], we wrote up and refined rich vignettes based on these moments, particularly attending to the involved actors, encounters, and shifting relationships. In so doing, the analysis, vignettes, and discussion work together to foreground the nuances and tensions that arise in the process of negotiating bottom-up sociotechnical imaginaries.

4 CONTAMINATION IN THE MAKING OF BOTTOM-UP SOCIOTECHNICAL IMAGINARIES

In this section, we will show a few vignettes from our PSD engagement. These vignettes aim to illustrate the encounter and contamination of varied visions of desired futures across different layers—from the individual perspective to newly-formed alliances, and ultimately to the collective.

4.1 Contaminating Individual Visions

Ms. Kisha, our most senior participant in the project, was in her 80s at the time of the project. Born in Chicago, she moved to Detroit with her mother at the age of five. Prior to her retirement, Kisha had a career as a computer technician with the city government. Given her professional background and firsthand experience witnessing the advancement of digital technologies during the Cold War era, she held a generally optimistic attitude toward emerging technologies.

Kisha comes from a large family with eleven grandchildren. When reflecting on her favorite aspect of the workshops, she recalled, "The part I liked the most was looking into the future, what I would like to see the future for my neighborhood. I won't be here, but my grandchildren will be here and that's what was very, very interesting." Indeed, for Kisha, speculating about the future meant imagining an inclusive and harmonious community and society—one where her grandchildren and future generations can thrive.

During the first workshop, we screened a segment from Black Mirror titled *The Entire History of You* to demonstrate the concept of a "dystopian future." This short video clip showcases a futuristic world where individuals have an implant that records everything they see and experience, allowing others to review and replay their memories at will. This concept raised many comments and discussions among the group. Many participants' immediate reactions, including ours, were to question the ethics and social consequences of such technologies. For example, Derrick, an early-stage college student and our youngest participant, considered the forced memory to be against the nature of body-mind:

> I think part of the struggle with the advancement of technology is sometimes it outpaces the discussion around how to use it and what role it plays in our daily lives. So the memory thing really got to me. Because often our brains do things to keep us alive, whether they're good or bad for us in the long run, is trying to keep us alive and functional. And a lot of times people suppress or repress traumatic memories, the brain does [that] for the purposes of keeping you alive, keeping you functional keeping you sane. And so, a lot of times we can't remember things that happened to us in detail.

Like Derrick, many participants found the idea of memory implants to be overwhelming. They expressed concerns about increasing biopolitical control, highlighting the potential for these augmentative technologies to be utilized as a governance device over minoritized communities. They also emphasized the intrusive nature of such memory implants, further blurring the human-machine boundaries and evading bodily autonomy. It was at this juncture that Kisha joined the dialogue, offering a perspective that differed from the rest of the group:

> My take is [that] if we were a futuristic society, we would need this technology. We would have to get into the era of being able to use this technology. It would be nice to be able to go back and bring up past memories, that would be really nice to do that because when you get my age you can't even hardly remember from one day to the next day, so that would be a really good thing for our economy, our society.

Here, Kisha offered her unique personal perspective and the viewpoints of older adults to the dialogue. By sharing the challenges she faced with memory at her age, Kisha foregrounded her personal vision that stood in contrast to the group's prevailing critique. She articulated how memory implants could hold promise in assisting seniors like herself in navigating everyday challenges and cherishing precious moments with family and friends, particularly their grandchildren. Indeed, encountering Kisha's vision was a critical moment of contamination for other participants. Reflecting on this experience, Derrick shared that:

When [Kisha] was talking about elderly folks... I was like, "Wow, that's a good point" because when I think about things, I usually think about the general human population. But I don't always explicitly consider people who may not be caught up with those things. I'm like... I have to rework my design in my head to include resources for those people to get up to speed, or resources for those people to if they can't get up to speed to... meet them where they're at, as opposed to expecting them to come somewhere where they can't.

For Derrick, this encounter rendered visible and challenged the boundaries of his own envisioned futures. This boundary negotiation unfolded not only among the community members but also within our own research team. It prompted us to reconsider our preconceived notions of what a dystopian society might entail and made us aware of the contextualized nature of individual visions. During our research team's debriefing after the workshop, we engaged in a reflection regarding how our own critique of emerging technologies was largely shaped by our critical education and confined by our assumptions as younger generations, which could further invisibilize the needs and voices of minoritized groups and communities in futuring.

This contamination of individual visions was also evident in another discussion involving Morgan, a queer community member in their 20s. Morgan brought a unique perspective to the conversation because of their past involvement in sex work and history of substance use. The sense of isolation associated with this traumatic experience led them to get involved in sex worker rights organizing in Detroit. Since moving to Detroit a few years ago, they have been putting effort into connecting sex worker communities and advocating for decriminalizing sex work to reduce violence against this community. During the first workshop, Morgan shared some of their personal experience with police and articulated their desired futures that prioritize the basic rights and safety of sex workers. Taking up an abolitionist viewpoint, Morgan speculated on a more equitable future where the heavy policing and surveillance technologies targeting sex workers would be replaced by mutual aid and collective care. Yet what Morgan shared was disruptive to the social norms perceived by other participants due to the pervasive stigma associated with sex work and drug use. Kimberly, for instance, shared her initial unease upon hearing Morgan's perspective:

[They] brought up a population that never comes up in my thought process, and that was either sex workers and the drug users or the drug dealers. Just advocating for them and thinking about them in terms of moving forward with the way we use technologies or want to create communities or economies ... threw me way off. I'm going to mull it over because I don't know what it means the fact that this threw me off or whatever it is that I was thinking about. But I'm thankful just for that to be brought to my attention that that's the population you don't think about, and so it's like, well what other populations are there that exist that don't get thought of?

Kimberly's quote illustrates how her encounter with Morgan's perspective disrupted her previous visions of a desired future—a future from the vantage point of a single mother that did not necessarily account for the marginalized sex workers struggling with drug use and criminalization. In our follow-up interview, Kimberly marked this encounter as one of the most pivotal moments throughout the entire project. She admitted that she initially felt "taken aback" and "uncomfortable" during this discussion. However, she soon recognized the need to shed her judgments and "listen outside of myself for new information from new people." As she reflected on her discomfort, she started asking herself, "Do I get to bring my own preferences in the creation of a utopia?" Recognizing the potentially exclusive aspects of her own visions, she shared with us that she had conducted further research on sex workers and explored ways to address the limitations of her own vision after the workshop.

Indeed, for both Derrick and Kimberly, the contamination of individual visions of the future demonstrates a process of self-and-other dislocation and transformation. In Kimberly's case, initially reading Morgan and their vision as deviant "others," Kimberly's encounter with Morgan compelled her to transcend her taken-for-granted frames of reference and reconsider the boundaries of her imagined future. Through this transformative encounter, Kimberly's self became entangled with others as her initially self-contained vision was destabilized and reconstructed. In thinking with Anna Tsing's notion of contaminated diversity, we recognize that this contamination of visions of desired futures fosters ways of relating in the present, disrupting established categories and creating new possibilities for collaboration across differences.

At the same time, participants noted that acknowledging their vulnerable perspectives with others was an uneasy process. Morgan, in particular, expressed hesitance in sharing their personal experiences, which had left them feeling somewhat "paranoid" about sharing their desired future. Morgan was particularly concerned about how fellow community members would respond to their perspective on sex workers and whether it might derail the group discussion. They told us,

I felt supported [about] how it was received, I mean I do worry that sometimes it comes off as like, I've had people say to me, "not everything is about sex work," and like "okay, I get it, but hear me out." It's important to look at these criminalized groups in the way that they survive.

In contrast to Kimberly's realization of the presence of others, Morgan's experience here illustrates the recognition that they were, in fact, perceived as an "other" by others. This kind of acknowledgment, while initially unsettling, forms a crucial foundation for fostering mutual understanding and forging new alliances among community members. As such, the opportunities that PSD provides for rethinking the self-other dichotomy [33] inherent in one's vision of the future and present existence render PSD a generative space for contamination and building new grounds for collaboration.

4.2 Negotiating Visions Among Alliances

As the PSD workshop series proceeded, new alliances started emerging among participants. During the Week 3 workshop, we invited

participants to join two groups to articulate their envisioned utopian and dystopian community futures. Among the participants, seven Black women chose to join the utopian group. In the breakout room, one participant first shared with the group that "Love is the glue that binds everyone together," suggesting the focus of joy and love in their envisioned utopian scenario. This idea resonated strongly with everyone in this group, and they began to share instances of how joy and love stemmed from the close-knit relationships among community members, particularly in places like beauty salons, barbershops, Black-owned restaurants, neighborhoods, and churches—places pivotal to the social gathering and well-being of Black communities.

Echoing previous research on technospirituality aimed at supporting social connections within Black communities [62], participating in church services was especially emphasized by the group members as a crucial way to foster joy and love within the community in their group vision. For instance, Kisha commented, "We need churches to be more involved [in the future]. In my grandmother's time, churches were the pillar of the community. If the churches didn't know, no one knew. In the future, we want to see more churches involved in building up, organizing, and addressing the needs of the communities." While everyone agreed with Kisha's sentiments, another participant contributed by suggesting that future technologies could be utilized to document all the minute acts of kindness or love committed by community members, such as providing church services and uplifting others in the community. This suggestion prompted the group to brainstorm ways in which future technologies could be designed to capture community members' moments of love and joy while also providing assistance with tasks like cutting the grass and mowing the lawn, especially for those who need support. With the aim of weaving communities together through care and love, the group collectively named their envisioned future "Count Your Blessings 1 by 1" (see Figure 1) and presented it to the larger group.

> We wanted to find a way to gauge our community's ability to express love [and] also identify who needed support. And [we wanted to] have a tool, like a Fitbit, that folks could use to kind of have their emotions gauged, but also as a reporting tool. If something had been done for them by a community member or if they had experienced something like a church service or activity that uplifted them, they could report this love emotion, or this support emotion that they felt as a result. [So] the community kind of coming together... We wanted it to be a loving community, and the community would be getting the service they needed through technology.

Tracing the process in which the group's vision emerged, it is evident that this vision was deeply rooted in the shared histories and lived experiences of this Black women alliance. For them, the aim of capturing joy and kindness was to facilitate traditional loving and nurturing community relationships, free from coercive control and exploitation. However, this envisioned future, especially the use of technology to monitor joy and love, triggered mixed reactions within the larger group. Two white participants, in particular,

expressed concerns regarding the ethical implications. Morgan, for instance, pointed out:

> I don't want someone to decide for me what kind of "love" I need. People should be empowered to ask for what they need... People are constantly trying to "rescue" me, contacting me through the advertisements I place online to work with messages of "Jesus loves you, there is help available." This is triggering to me because I have religious trauma, and doesn't actually meet any of my needs, money, food, transportation.

Another participant, Sophia, similarly questioned that "Faith institutions are something that isn't [part of] many people's idea of a utopia, so why is that included in this utopia?" Sophia is an LGBTQ activist working with youth in metro Detroit, and she is particularly cautious about the use of surveillance technologies and their consequences on queer youths. With regard to the idea of monitoring joy and love for care, Sophia questioned how joy and love would be measured and cataloged, especially considering that everyone's expression of love differs. Even if this imagined technology could detect joy and love, how would it determine what kinds of care community members need? And would the technology seek consent before providing care? While insightful, these critiques on seeking consent for care and situated expressions of love provoked an unexpectedly heated debate on cultural differences and community norms among different participant alliances. Among others, Shauna stood out and responded to Sophia and Morgan's comments:

> [This] sounds like a community taking care of each other. This is very common amongst Black communities. It is culturally specific, or culturally informed. In my community, doing for others before the need to ask, or without the need for a thank you or exchange of payment, was a norm. [This] definitely required an understanding of our identity as neighborhood and [it has] shifted with gentrification in the city.

Here, Shauna emphasized that the analysis of the alliance's vision of the desired future cannot be divorced from the cultural scripts and communal norms shared within Black communities. Another participant who was not part of the utopian discussion group echoed this sentiment, emphasizing that this vision could only emerge from the interdependent relationships within the community rather than being predicated upon the advancement of surveillance technologies. She stated,

> There was a collective responsibility... African people are communal people. It's our nature to live in communities, [but] now we're living contrary to our nature. And it's not helping, and technology is not going to help either until we become back to [as communal as] who we were.

This debate demonstrates the contamination of future-oriented visions across racial and cultural differences, where various alliances' cultural norms and partial viewpoints encountered and clashed with one another. Similar to the process of encountering various individual perspectives described earlier, the contamination
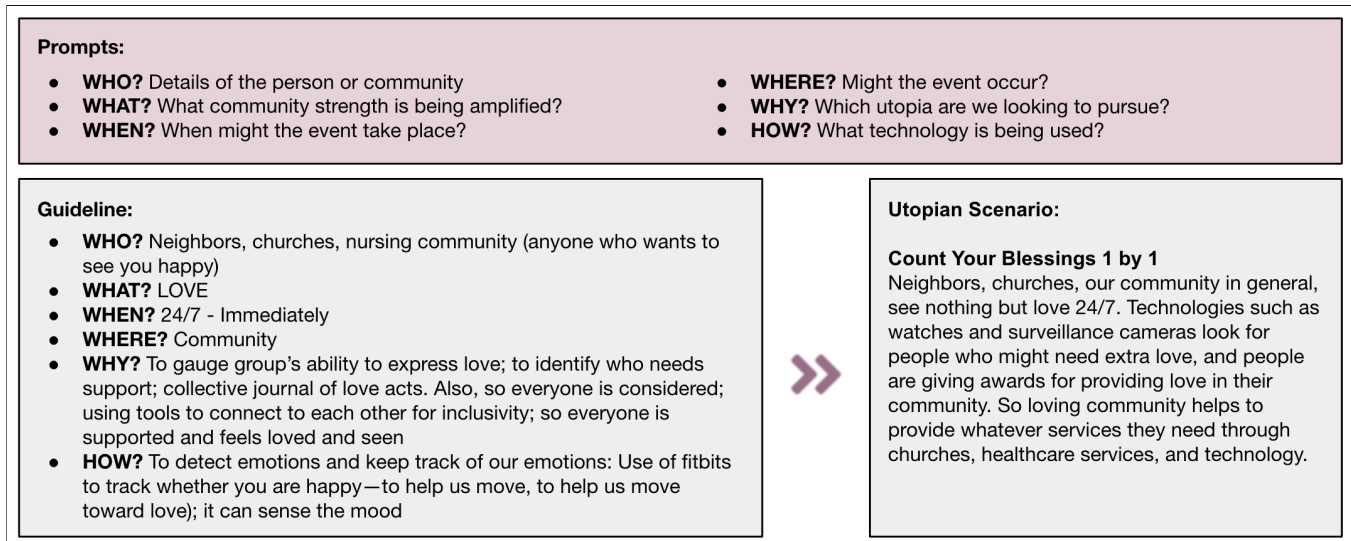
Prompts:
- **WHO?** Details of the person or community
- **WHAT?** What community strength is being amplified?
- **WHEN?** When might the event take place?
- **WHERE?** Might the event occur?
- **WHY?** Which utopia are we looking to pursue?
- **HOW?** What technology is being used?

Guideline:
- **WHO?** Neighbors, churches, nursing community (anyone who wants to see you happy)
- **WHAT?** LOVE
- **WHEN?** 24/7 - Immediately
- **WHERE?** Community
- **WHY?** To gauge group's ability to express love; to identify who needs support; collective journal of love acts. Also, so everyone is considered; using tools to connect to each other for inclusivity; so everyone is supported and feels loved and seen
- **HOW?** To detect emotions and keep track of our emotions: Use of fitbits to track whether you are happy—to help us move, to help us move toward love); it can sense the mood

Utopian Scenario:

Count Your Blessings 1 by 1
Neighbors, churches, our community in general, see nothing but love 24/7. Technologies such as watches and surveillance cameras look for people who might need extra love, and people are giving awards for providing love in their community. So loving community helps to provide whatever services they need through churches, healthcare services, and technology.

Figure 1: The utopian scenario, titled "Count Your Blessings 1 by 1," was envisioned by a group of community members during the Week 3 workshop. The text within the top red box are the prompts provided by the research team, and community members completed the text in the bottom grey boxes during the workshop activity.

of visions at the alliance level can also be uncomfortable. Recognizing the need for intervention, the community staff within the research team stepped in to moderate this dialogue, ensuring both alliances could understand each other's perspectives and thereby find common ground. Taking the racial and cultural differences to the fore, as a result, created a unique opportunity for these alliances to further negotiate the boundaries around themselves and their desired futures, which led to important reflections within the alliances. For instance, one participant in the utopian discussion group recognized that their alliance's envisioned future must rely on community ownership and governance over the technology design and deployment. She elaborated:

> None of these things will be done unless that is what the community wants. If the community wants... to hang up cameras to see what is needed in their community, this is what we get. If the community wants someone to cut their grass... we're going to be meeting with churches, with businesses, with residents to really find out what our community is needing, what they're lacking, and what they would like to see.

Participants in the other alliance similarly reflected on the limitation of placing excessive emphasis on consent and critiquing technologies within the confines of existing power arrangements and structures. In thinking with the situated knowledge of Black women participants, they reflected on how their critique could foreclose the possibilities of rethinking the sociotechnical futures through alternative ways of living and relating. For instance, Morgan later shared that,

> I think we can hold both realities! Community care that doesn't depend on technological surveillance– but on relationships... I guess it makes sense to go from bottom up, instead of top down with that, like if

it's created by the people who are using it then you don't have those problems. But it was interesting to see that difference, because I heard about something like that, and that's like "Oh no, no, no, I don't want that," but that was what they saw as something that was important.

And as a result of this debate, based on community members' feedback, we incorporated "Principled Struggle" into our invitations for engagement (see Section 3.2). Indeed, instead of refusing contamination, we saw members of different alliances troubling and opening up the visions that they believed to be the only viable possibilities for an equitable sociotechnical future. The PSD workshops crafted this space for the encounter among partial knowledge and situated standpoints. Importantly, it signifies an uneasy process through which various fragmented alliances expose and recognize the very partiality of their own perspectives, thereby fostering new connections between the otherwise segregated "us" and "them."

4.3 Weaving and Acting Upon a Collective Sociotechnical Imaginary

With the ongoing contamination and negotiation of desired futures at both the individual and alliance levels, actors and relationships encompassed within these visions became increasingly diverse. Shared understandings of mutual aid, communal care and nurturing, and community economy started to take center stage in speculating economic alternatives. During the Week 4 workshop, participants were randomly divided into two small groups and tasked with envisioning alternative economy scenarios for their communities. We invited both groups to create a text-based storyboard with eight scenes to illustrate their scenarios. Surprisingly, without any pre-arrangement, both groups independently chose to focus on the shared economy of childcare in the future, presenting similar
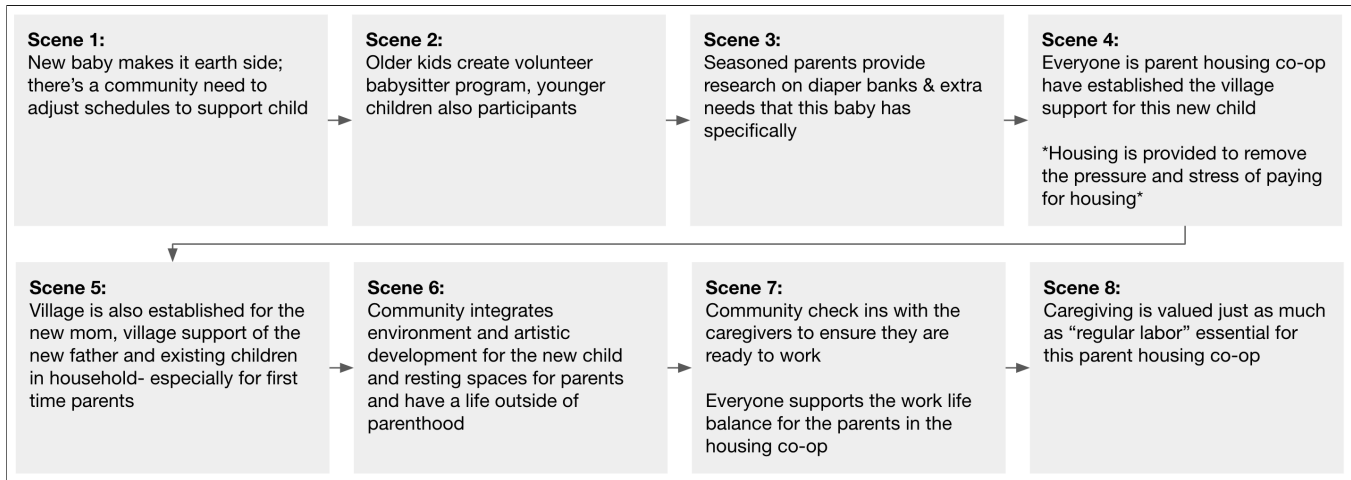
Scene 1: New baby makes it earth side; there's a community need to adjust schedules to support child	**Scene 2:** Older kids create volunteer babysitter program, younger children also participants	**Scene 3:** Seasoned parents provide research on diaper banks & extra needs that this baby has specifically	**Scene 4:** Everyone is parent housing co-op have established the village support for this new child *Housing is provided to remove the pressure and stress of paying for housing*
Scene 5: Village is also established for the new mom, village support of the new father and existing children in household- especially for first time parents	**Scene 6:** Community integrates environment and artistic development for the new child and resting spaces for parents and have a life outside of parenthood	**Scene 7:** Community check ins with the caregivers to ensure they are ready to work Everyone supports the work life balance for the parents in the housing co-op	**Scene 8:** Caregiving is valued just as much as "regular labor" essential for this parent housing co-op

Figure 2: Participant-produced storyboard for the collective sociotechnical imaginary on alternative communal childcare

ideas. While one group named their alternative economy concept "decentralized childcare collectives," the other group named theirs "village-based childcare." [5]

In these imagined scenarios, both groups aimed to distribute the labor of social reproduction and re-envision collective approaches to nurture the future generations of their community. As shown in Figure 2, this shared vision can be viewed as a direct response to the challenges posed by the precariousness of parenting and caregiving within the prevailing capitalist frameworks of today. Each scene within this storyboard serves as a deliberate reimagination of challenges low-income Black and brown communities in Detroit and beyond face, including disenfranchisement, segregation, and unequal access to housing and food. Reimaginations also included opportunities for flourishing. We believe that this collective focus on reimagining childcare was shaped not just by the caregiving role of the majority of participants, particularly Black women, but also by the common understanding that has developed through continuous interaction and ongoing contamination. Even for participants who had not necessarily played a more conventional parenting role or actively resisted conventional heteronormative family concepts, they were able to locate their interests and actively participate in weaving together this collective imaginary. For instance, a participant commented,

> A lot of what was talked about [was] not just in a mothering way but for everyone, and it takes a village kind of way... [and] I appreciate it that. I mean not everyone, historically, has been able to have the mom-stays-home situation. Most people have had to work and haven't had the luxury of being able to stay home with their children as much as they deserve, and especially [for] people who get forcibly removed from the lives of their children. So [our imaginary helps with] how we can support people in their relationships and make room for the different family configurations.

In this case, differences served as a fertile ground to search for common interests for the future, rather than being fixed categories for exclusion. Indeed for the majority of participants, it was both intriguing and exciting to witness a collective sociotechnical imaginary taking shape within the group. They recognized that active listening and reflection created an important space for collaboration over differences and contamination. Kisha, for instance, said that,

> It was interesting everybody had their own ideas... but it was nice when we all came together as one into [imagining the future], that was good... I valued everybody's opinion, and I believe that everybody should have a voice and voice their opinion... You have to listen, you give your views and your points, and then you listen to other people. And if it wasn't trying to persuade someone to want to go your way, you just listen and it just came together on a song, be no persuade nor anything.

For Kisha, collaborative futuring through contamination required everyone, including herself, to attune themselves to each other and their narratives, seeking relational alignment for the collective futuring at hand. This alignment on futuring thereby served as an important site for building political power at the present. In the last workshop, we delved into strategies to shift toward our desired communal childcare through forging collective actions. Participants brainstormed collaborative ways to foster political power within the group, identifying potential steps to resist the hegemonic power structures in place actively. This discussion took on added significance in light of the upcoming city election in late 2021. Consequently, during the workshop, participants engaged in conversations about acting upon their collective imaginary and extending this imaginary to broader communities in Detroit neighborhoods, with the aim of fostering democratic civic participation and mobilizing collective actions. One participant shared:

> People [need to] understand how politics and your decisions to vote or not vote for a certain individual

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[5]Readers can find details of these alternative economy concepts in the past article [18].

or party or whatever ideology impacts their day-to-day. A lot of people that we talked about are being disenfranchised by the current state of politics and are caught in survival mode, and it may seem to them like they don't have time or energy to even care or to participate. That narrative needs to be changed... What people are most concerned about [are] themselves right now... instead of a commitment to our commitment to one another.

Here, this participant pointed out the dual nature of precarious survival in light of performing bottom-up imaginaries, which requires political participation from the broader community beyond this PSD engagement. On one hand, the immediate experience of precariousness could confine community members as isolated subjects, devoid of temporal and spatial complexities, hindering opportunities for collaboration. On the other hand, when community members commit to understanding the conditions that give rise to their shared precarious situations, it could lead to a collective recognition of shared precarity rooted in systems of domination. This acknowledgment, in turn, acts as a starting point for articulating collective political action and engagement, or in Tsing's words, turning a gathering into a "happening" [70, p.29]. Indeed, following the PSD workshops, the alignment stemming from the collective imaginary guided CO in prioritizing key agendas and core values in their community organizing. The collective formed during the PSD workshop also worked with the CO to organize canvassing and political education, motivating more community members to commit to and participate in the city election through voting.

Taken together, these vignettes demonstrate the open-ended yet generative contamination took place on individual, alliance, and collective layers during our PSD engagement. Across these layers, we have seen how the contamination dynamics unfold: *encountering others*, *acknowledging partiality*, *experiencing self-other transformation*, and finally *articulating new alliances*. Through this escalating process of contamination, we see a bottom-up sociotechnical imaginary was negotiated, assembled, and temporarily stabilized, which was in turn acted upon by the newly formed collective.

5 DISCUSSION

In the following discussion, we further theorize contamination in relation to the concept of sociotechnical imaginaries and offer methodological reflections on opportunities to foster contamination in the PSD space. Examining contamination in this way provides entry points into how people can seek commonalities across differences, incorporate otherness into imagination, and foster present political agency through collaborative survival. Considering this year's PDC theme of "connecting beyond participation," we believe that the ability to foster uneasy yet generative contamination within the PSD space can transform mere participation into collective "happenings" going forward.

5.1 Contamination as a site for Resistance in PSD

As Ytasha Womack puts it, imagination is "a tool of resistance" [72, p.24]. Indeed, rather than proposing yet another rationalist solution, be it through design or policy interventions [21], PSD

approaches have been instrumental in democratizing imagination among impacted communities and waging resistance to the dominant sociotechnical imaginaries shaped by global capitalism and patriarchal modernity [22, 45]. The making of community-held sociotechnical imaginaries at the margins elicits multiple possibilities of alternative futures that co-exist *within* and *beyond* the confines of present realities. These coproduced bottom-up imaginaries denaturalize dominant imaginaries of progress that are rooted in modernist ideals and often frame technological advancement as teleological or inevitable [3, 24, 64].

Importantly, our work has demonstrated that there are *no* pre-existing community-held sociotechnical imaginaries at the margins—they are not latent artifacts or narratives that can be "discovered" and then used as devices for resistance. Recall that while Morgan's vision of desired futures centered on advocating for the basic rights of sex workers, sex workers were not part of Kimberly's visions. While the alliance of Black women envisioned technologies to foster love and mutual support within communities, other alliances that were not part of the Black community prioritized seeking individual consent in the use of new technologies. As we have shown, these community members' and alliances' visions of desired futures are deeply rooted in their historical legacies, lived experiences, and situated knowledge, and they are sometimes in conflict with one another. Our PSD workshops, in this sense, crafted a relational space wherein community members encountered one another and made sense of the otherwise othered situated visions, and as a result, the boundaries of the originally stand-alone visions were opened up, disrupted, and (re)contaminated. Through ongoing contamination, these otherwise stand-alone and fragmented visions are weaved together and emerge as a temporarily stabilized bottom-up "sociotechnical imaginary"—this weaved vision becomes an "imaginary" only when it is collectively held, communally adopted, and can be acted upon by the community [42].

We, therefore, argue that the potential for PSD efforts to serve as a site of resistance precisely lies in its ability to stage encounters among already othered and marginalized community members and foster encounter-based contamination among them. Here is where we see contamination plays a critical role in enabling resistance and fostering diversity within PSD, spanning three dimensions—ontological, epistemological, and political.

First, we position acknowledging and embracing contamination in the PSD space as an ontological commitment, enabling community members and us to reject the myth of existing in purity and self-containment. In postcolonial scholar Edward Said's words, "In our wish to make ourselves heard, we tend very often to forget that the world is a crowded place, and that if everyone were to insist on *the radical purity or priority of one's own voice*, all we would have would be the awful din of unending strife" [63, p.xxi, emphasis added]. Recall the cases of Kimberly and Derrick, the purity or priority of individuals' own voices and needs in their desired futures are contaminated by situated needs that are otherwise othered and perhaps suppressed, and so do the assumed purity of individual community members' selves and experiences. It is precisely this encounter-based contamination that leads to reflexivity, new relations, and "contaminated diversity" towards the future [70].

As such, contamination taking place during PSD is in fact the negotiation and reconfiguration of collective cultural identities at

present. As we observed in our workshops, the process of contamination is blurring the boundaries around identity categories constructed for hierarchy and exclusion [7]. In our case, it is a process of articulating alliances across race and culture in order to bring precarious working-class community members—including seniors, single mothers, sex workers, and more—together. In this process, we argue that naturalized identity-based otherness is deconstructed and reconfigured for both future possibilities of co-existence and present opportunities for collaboration. To be sure, contamination is not about constructing *one* new essentialized identity category, or falling back into the trap of sameness, among community members but about sharing intersectional experiences [23, 32] and articulating new intra-active relationships [2]. Indeed, according to Dindler and Iversen, producing and engaging a multiplicity of relational expertise is a core competence of PD [19]. The opportunities for contamination in PSD precisely make space for dealing with multiplicities across temporalities—the multiplicity of practices, relationships, expertise, and possibilities [43, 50, 56]—with the heterogeneity of standpoints and partial knowledge [34, 36]. And the preferable future possibilities are not constituted through individual purity and autonomous singular sameness; instead, they only emerge from newly forged and existing interdependent relations in which we participate and collaborate with others. And following Wong et al.'s emphasis on addressing critical infrastructures in speculative design [73], these new collaborations and existing relations locate needed grounds for fostering and maintaining alternative human and sociotechnical infrastructures.

Second, the process of contamination is a site of knowledge production that challenges the dominant knowledge practices and institutionalized sociotechnical imaginaries that are undergirded by rationality and scalability. We propose to advance contamination as an analytical lens for knowledge generation in PSD and PD going forward. Taking contamination as an analytical lens invites researchers to closely attend to the dynamics of *encountering others*, *recognizing partiality*, *experiencing self-other transformation*, and *articulating new alliances for collaboration* in the escalating processes of negotiating sociotechnical imaginaries within the PSD space. In so doing, we have shown that contamination tells invaluable stories about how community members are related to and affected by the otherwise suppressed others and their visions of desired futures. In thinking with McKittrick and Tsing, among others [34, 36, 55, 70], these open-ended and often troubled stories of contaminated diversity across temporalities are historical, perpetually shifting, and profoundly relational. By inviting situated contingencies and indeterminate collaboration into the process of knowledge production and imagination in PSD, contamination offers entry points to make visible and center those unacknowledged aspects and open-ended stories of the knowing, living, and relating that make collaborative survival and thriving possible [24, 55].

Third, the resistant potential of contamination in the PSD space also lies in constituting political power and fostering collective actions from the margins. In our case, community members and CO were able to start performing the bottom-up sociotechnical imaginary that emerged from the PSD workshops through initiating collective actions around public outreach, facilitating political education sessions in the community, and organizing voting campaigns to directly shape the local democratic agenda. As Opazo and

colleagues noted, "To think about design in terms of imagining the world otherwise—and *act accordingly to change it*—already involves an evident political edge" [59, p.75, emphasis added]. We note that this capacity of collectively acting upon the bottom-up imaginaries is inseparable from the process of "becoming common" made possible by ongoing contamination in PSD [48].

Again, the common here is not merely a singular identity category; instead, in Lorey's words, this common is "something that must first emerge, that has first to be put together, that does not yet exist" [48, p.7]. In extending upon the previous example of Morgan and Kimberly, becoming common was not only about becoming aware of each other's situated struggles as a single mother and a former sex worker, but making sense of how their struggles are situated in similar power arrangements of exploitation and oppression. To them, becoming common was a process of seeking the intersectional grounds in different manifestations of otherness and experiences, as well as locating the possibilities for solidary political actions. Indeed, practices of becoming common create shared space to embrace difference and otherness, as well as for potentially conflicting heterogeneity, which are both defined by complex entanglements and interdependencies [26, 58]. In our case, we observe that this process of constituting political agency through contamination is inherently uneasy, and at times risky. It places already marginalized community members in direct confrontation with conflicts, compelling them to engage in the act of staying with the trouble and living with uncertainties [35]. Yet, we recognize that it is precisely this confrontation that sets the foundation for articulating multiple future possibilities and nurturing collective projects for social and political change. Taken this way, becoming common through contamination in PSD is both the practical means and a political goal, as communities come together, grapple with discomforts, and find strength in their shared struggle for more inclusive sociotechnical futures.

5.2 Methodological Reflections and Invitations: Fostering Contamination in PSD

Given the generative potential of contamination, we ask: how might we foreground contamination within processes of PSD, or PD more broadly? This is an invitation for PSD researchers and practitioners to reckon with what approaches might lend the community collective to contamination and how we might facilitate the difficult conversations that could emerge? Even though we did not go into our project with the explicit goal of designing contamination, or perhaps contamination is never meant to be designed per se given its open-endedness, our project offers three important lessons learned toward fostering contamination in PSD and PD going forward.

5.2.1 Co-cultivating a safe space for contamination through reflexive partnership and norm negotiation. Fostering contamination starts with making a shared space for different visions to be surfaced for encountering. In this space, community members should be both *willing* to and *able* to understand, (dis)agree, and grapple with perspectives that are very different from themselves. It facilitates encounters, hosts conflicts, and more importantly prompts the reconstitution of selves and collectives, with stories of histories and futures competing for visibility and legitimacy [63].

The key to making this space generative for community members was twofold in our PSD project. First, our community-based participatory approach was undergirded by our close partnership and iterative collaboration with CO, which has existing working relationships with involved community members. Through weekly check-ins and debriefings after each workshop, along with constant feedback from community members, we were able to attend to the evolving dynamics within the space and adapt our workshop design and facilitation accordingly. Second, as articulated in the methods section, we sought to set up norms for this space through open invitations for engagement and participation at the beginning of each workshop (see Section 3.2). Importantly, we encouraged community members to challenge and co-shape the norms, making sure these participation invitations reflected the shifting relationships within the space. For example, "principled struggle" was added as a new item to the invitation of engagement amidst our workshops series. Indeed, many community members expressed feeling encouraged to share their vulnerability and reckon with others' perspectives precisely because of these foundational agreements. This willingness to share and listen, to agree and disagree, to believe and support—or to be contaminated and become common—is the key to fostering contamination in such participatory processes. In addition, we actively prompted various modes of expression and participation during our PSD engagements [61], from verbalizing thoughts through discussion to text-based chat contributions and anonymous voting. Indeed, contamination is open-ended, messy, and open to improvisation [70]. These diverse ways of expression therefore create critical time and room for reflection, allowing participants to forge new connections and incorporate the otherwise othered into collective visions.

5.2.2 Taking discomforts as opportunities for intervention and fostering new connections. Part of contamination involves friction and discomfort, especially during the encounter of otherness and the acknowledgment of one's partiality. Yet, these frictions can be generative, surfacing otherwise invisibilized power arrangements and thereby moving the sociotechnical discussions and alternative infrastructuring forward in the PSD setting [27]. We, as facilitators, then must be attuned to the opportunities for ad-hoc intervention and mitigate the uneasiness during the PSD process. For instance, recall when Morgan shared their stigma associated with sex work and substance use, community members might revisit their past experiences that are at times traumatic for the communities that we are working with. Recall the conflict between Sophia and the Black Women alliance required community members to confront and rethink their previously unchallenged perspectives. In both cases, community members are invited to open up the closed-up boundaries of their selves and their future visions, rendering them both permeable and vulnerable. In navigating such uneasiness, our community partners' expertise and knowledge about the community was invaluable. As we have seen, they intervened in such conflicts to situate the debate within the broader social, cultural, and historical contexts. Interventions like this were critical in facilitating involved community members to recognize and grapple with the structural forces that shape their visions that are seemingly disconnected yet deeply intertwined with one another. This awareness is especially precious in establishing the new solidary ground for reconfiguring the social positions and collective survival.

5.2.3 Sustaining contamination beyond the boundaries of PSD workshops. Finally, acting upon the negotiated bottom-up sociotechnical imaginaries requires maintaining the momentum and possibilities of contamination beyond the conclusion of PSD workshops. Design researchers have reflected on the methodological limitations of design workshops as sites of engagement and intervention due to their defined temporal and spatial boundaries [61], as well as their potential to alienate already the othered peoples from further participation [38]. In light of these critiques, PSD workshops are just starting points for realizing these bottom-up imaginaries with the alliances formed during the process. Rather than seeing these imaginaries and alliances as stabilized across space and time, they are new actors-in-relation within the broader communities, inviting indeterminate collaboration and further contamination. This takes time and ongoing infrastructuring work from both the COs and researchers to coordinate, organize, and mobilize collective actions beyond the scope of the original PSD project [71]. In our case, taking up the emerged imaginaries and their underlying values in the local political education, canvassing, and voting campaign during the city election was an important step. Yet, it is vital to call out that sustaining contamination beyond PSD workshops is indispensable from the labor of community collectives in their anticipation work [68]. Indeed, it is their openness to sharing vulnerability and collaborating across differences that drive the collective efforts to pursue accountability and liberation moving forward.

6 CONCLUDING REMARKS

Our turn to contamination taking place in PSD is an inquiry into how PSD projects might serve as generative space for reweaving communities together for a world that's otherwise. Through contamination, we as researchers, community organizers, and already othered community members encounter, contact, and build coalitions along shared struggles and experiences. The making and negotiation of community-held sociotechnical imaginaries resist the myths of purity—epistemological objectivity, ontological containment and clear-cut identities, and political control over otherness. However, it is important to note that neither the coalitions nor the negotiated bottom-up sociotechnical imaginaries are stable or complete—they are shifting beyond the boundaries of the design workshops and requiring ongoing work of maintenance and mobilization. After all, contamination offers a fruitful theoretical and practical grounding for us to attend to the relational nature of community-held sociotechnical imaginaries and PSD engagements. It provides an opportunity for nurturing reflexivity in knowledge production, while simultaneously challenging and reconstructing more inclusive sociotechnical futures.

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A   WEEKLY PSD WORKSHOPS

Our PSD series consisted of five weekly online workshops. Week 1 introduced the concepts and goals of speculative design and outlined workshop goals. The primary goals focused on envisioning alternative digital economies and understanding technology's role in supporting them. While we introduced key terms like "design fiction" and "speculative design," we avoided defining capitalism and instead introduced the concept of "economy." Finally, we introduced

and discussed emerging technologies like Artificial Intelligence using short video clips from the science fiction series "Black Mirror" to stimulate creative thinking and show examples of speculative futures. The clips included scenarios involving memory implants and the accumulation of social credit affecting socioeconomic status. By reflecting on these video clips, participants also discussed their own personal visions of utopian and dystopian futures.

Week 2 focused on exploring alternative economies and community values. We introduced participants to the "Building Utopias" workbook [8] and asked them to identify their top community values and strengths through a voting process. Following the voting process, we discussed the relationship between technology and their values, considering how technology could either support community strengths (utopian future) or exploit them (dystopian future). We then showed another video excerpt showcasing growing technologies like the Internet of Things and Robotics. We introduced the "Building Utopias" card deck, including Liberation, Forecasting, and Methods cards, and divided community participants into small groups based on their preferred timeframes for speculation (10 or 100 years in the past or future). Each group articulated their imaginaries of how their communities lived during their chosen time and how technology could support the community's economy.

Week 3 focused on understanding the collective strengths of the community and how to build desired futures around them. The relationship between technology and community strengths was explored, with short videos showcasing real-life examples of technology amplifying community strengths. Community participants discussed where they sought guidance, how they accessed information, and how they supported each other. We then divided participants into two small groups to envision utopian and dystopian community futures based on their own preferences. We provided participants with a shared online workbook to complete this activity, addressing questions about the who, what, when, where, why, and how of these scenarios. Finally, presenters from each group shared their scenarios and thought processes with the larger group.

Week 4 introduced the concept of alternative economies and the "Tools" deck. They discussed what alternative economies meant to them and watched videos illustrating various alternative economic concepts, including care economies, worker-owned co-ops, barter/trade, and alternative currencies. We then randomly assigned participants to small groups and used an online workbook to envision and storyboard alternative economic concepts. Community participants nominated facilitators, timekeepers, notetakers, and presenters within each group. Workbook prompts offered guidance for participants to think about goods/services exchanged, currencies, values, workers, and participation in their envisioned economies. We provided "Tools" cards, such as "Education," "Data," "Digital Solution," and "Community Spaces," to facilitate the imagining process. Presenters from each group shared their sociotechnical imaginaries and storyboards with the larger group.

The final week allowed for a recap of all workshop sessions and allowed community participants to share tangible ways to work toward their desired futures. Participants reflected on the workshop and brainstormed the next steps. This session also served as a space for community participants to express their thoughts and for the team to show appreciation for their contributions and the organization's involvement.