

# Negotiating sustainable futures in communities through participatory speculative design and experiments in living

Simran Chopra  
Northumbria University  
Newcastle upon Tyne, United  
Kingdom  
simran.chopra@northumbria.ac.uk

Rachel E Clarke  
Open Lab, Newcastle University  
Newcastle upon Tyne, United  
Kingdom  
rachel.clarke@newcastle.ac.uk

Adrian K Clear  
School of Computer Science, NUI  
Galway  
Galway, Ireland  
adrian.clear@nuigalway.ie

Sara Heitlinger  
Dept. of Computer Science, City,  
University of London  
London, United Kingdom  
sara.heitlinger@city.ac.uk

Ozge Dilaver  
Entrepreneurship, Innovation and  
Strategy, Northumbria University  
Newcastle upon Tyne, United  
Kingdom  
ozge.dilaver@northumbria.ac.uk

Christina Vasiliou  
Northumbria University  
Newcastle upon Tyne, United  
Kingdom  
christina.vasiliou@northumbria.ac.uk

## ABSTRACT

This paper responds to sustainable HCI's call to design long-term participatory projects with grassroots communities to counter the local effects of climate change and support more viable practices. We contribute a methodological approach to participatory speculative design as a series of interrelated experiments in living, working in symbiosis with a food-growing community moving towards collective resilience and food sovereignty. As an example of sustainability research within HCI, community food-growing has predominantly focused on collaborative acts of growing rather than disagreements, divergences and frictions. Limited attention has been paid to the challenges of effectively negotiating collaborative, sustainable speculative futures in this context. This paper reports on a workshop series on sustainable community food-growing using situated participatory speculation to address potential tensions when working collaboratively towards socio-technical alternatives.

## CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**; **Field studies**.

## KEYWORDS

Sustainability, Grassroots Communities, Food Growing, Participatory Speculative Design, Visioning

### ACM Reference Format:

Simran Chopra, Rachel E Clarke, Adrian K Clear, Sara Heitlinger, Ozge Dilaver, and Christina Vasiliou. 2022. Negotiating sustainable futures in communities through participatory speculative design and experiments in living. In *CHI Conference on Human Factors in Computing Systems (CHI '22)*.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than the author(s) must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from [permissions@acm.org](mailto:permissions@acm.org).

CHI '22, April 29-May 5, 2022, New Orleans, LA, USA

© 2022 Copyright held by the owner/author(s). Publication rights licensed to ACM.

ACM ISBN 978-1-4503-9157-3/22/04...\$15.00

<https://doi.org/10.1145/3491102.3501929>

April 29-May 5, 2022, New Orleans, LA, USA. ACM, New York, NY, USA, 17 pages. <https://doi.org/10.1145/3491102.3501929>

## 1 INTRODUCTION

Recent debates in Sustainable HCI (SHCI) have grappled with questions of how sustainability is defined [96], and how sustainability in design or design for sustainability are evaluated [101]. One aspect of this is SHCI's shift from understanding individual goals and behaviour to acknowledging the importance of understanding sustainability as a consequence of longitudinal social practices [76, 78, 105]. As well as this, there is an increased recognition that for longer-term environmental change, ideas of sustainability and visions of urban futures should not only be developed by experts [23, 98]. While specific professional expertise may have a role to play, local urban communities who are anticipated to be significantly affected by climate change are considered to be in an informed position to articulate and imagine a more environmentally sustainable future for themselves [46, 89]. Local knowledge can contribute key insights that bring into focus an appreciation of place [50], intersecting histories, and fragile ecosystems [5, 30, 40] in this context.

Community food growing, as an example of sustainability research within HCI, is recognised for its potential for bringing about citizen-led, on-the-ground change through sustainability practices [71]. Local grassroots initiatives involving bottom-up, citizen-led movements often lead to the establishment of long-term urban food growing communities [70, 85] that operationalise sustainability values through their practices. Although communities of practice promise self-sufficiency and sovereignty in local food systems [93, 97] they still face difficult challenges that limit the possibilities for change, like restrictive local government policies, economic and infrastructure viability, and participation and inclusivity [8, 14, 61].

Participatory Design has a long history of working with communities, taking into account their socially constructed practices with open, dynamic and heterogeneous structures of participation to respond to issues of concern [42, 75]. Moreover, both Participatory and Speculative Design, share an underlying commitment to viewing design as embedded in the production of publics [63], making social and political issues and shared struggles visible [88]. The

motivation with this is to foster careful assemblages and alternative pathways for connection and participation [16], thereby engaging communities in long-term commitment to the creation of publics and to on-the-ground change. SHCI has recently acknowledged the potential of speculative approaches and associated practices for challenging normative socio-technical systems [41, 48] and for thinking more expansively about alternatives to them [111]. Relevant work in this area has focused on involving stakeholders to imagine alternative futures [106], co-designing with grassroots communities and citizen-led initiatives [9, 114], and fostering resilience in the face of uncertainty about the future [8].

In this paper we report on an exploratory series of *Participatory Speculative Design* (PSD) workshops designed to support and scaffold the community's ongoing infrastructuring efforts of a local urban food growing community. The research is part of a long-term project involving academia and a local community interest company (CIC) based in an economically deprived neighbourhood in the UK. Our approach focused on understanding the everyday practices of the community and their future socio-technical visions for food growing and how these are positioned within, and constrained by, the local and larger socio-political contexts of the neighbourhood, the city, and the UK. We frame our research through the *Science and Technology Studies* (STS) lens of "*The Sustainable Living Experiment*" [87]. In doing so, we acknowledge the infrastructuring [21, 37, 75] that has and is taking place in the community, before and during our research, and which has shaped how the community imagines, negotiates, and changes everyday habits and habitats. We set out to investigate what design approaches and technologies can meaningfully support communities in their infrastructuring for future sustainability envisioning.

Value of such participatory activities to design is evident in sustainability grassroots communities; however, little research has attended to the methodological work of effectively speculating about the future. Which, as we demonstrate, involves eliciting community understandings and concerns, negotiating contested ideas and values, and the struggle to balance between boundless speculation and the uncompromising realities of the situated everyday. Our findings focus on methodological insights in fostering community engagement and citizen participation for practices of co-speculation about the future. We contribute reflections on our methodological approach as evolving [6] different modes of co-speculation through acts of invitation, situatedness, deliberation and crafting.

This paper expands on prior methodological works by [10, 114] by focussing on negotiating conflict, tension, anxiety and fear that surfaces between local and global sustainability concerns. Through four speculative modes; mapping to support common ground; walking to situate everyday forms of speculation; game play to support agonism and crafting to speculate on diverse community experiences; we illustrate how each method scaffolded longitudinal community engagement with issues of future socio-technical ecological sustainability. Our contribution is in highlighting the challenges and successes of these ways of designing for longer timescales necessary for sustainable living while navigating local and global concerns for the environment. We argue designers, researchers and practitioners need to pay attention to the importance of challenging normativity of scenarios; challenging normative role of

the researcher; balancing agency, politics, and deliberation in participatory speculative design; and community driven technology visions grounded in the experiences of everyday food growers in the community.

## 2 RELATED WORK

SHCI has reported on grassroots urban food growing to demonstrate and support how communities work toward sustainability in everyday life [17, 94, 100]. Work in this area has focused on environmental sustainability through agro-ecological system design [99], human-animal cohabitation [83], urban food informatics [32], and development of value-based socio-technical systems [93]. Heitlinger et al. [70, 71], through work on grassroots community-based urban farming, highlight possibilities for anticipatory collective action towards alternative futures that are more sustainable both environmentally and socially. Norton et al. [93] in their long-term engagement with two permaculture communities highlight the importance of value elicitation in an action research initiative to design and develop information systems. In line with our work in this paper, they conducted a workshop to understand the community's shared design future by guiding members through a co-design exercise. This co-created food growing future then informed the design of socio-technical systems for the community.

While the value of such participatory activities to design is clear, little research has studied the methodological work of effectively speculating about the future. As we demonstrate through this paper involves, eliciting community understandings and concerns by negotiating contested ideas and values. While struggling to balance between boundless speculation and the uncompromising realities of the situated everyday. Speculative design and associated approaches for instance, have been drawn on to highlight damaging anthropocentric consequences in the near future [13, 27, 110]. Here, designing for longer timescales is becoming particularly prescient for many urban communities due to the scale of the challenges and ever increasing threats presented by governance, degrading environments, and growing urban populations [33, 83]. A variety of future oriented approaches which can be defined as emancipatory, critical or reflective have highlighted that there are often a range of techniques and responses to design that work towards more sustainable collective futures [77].

Speculative design and related methods can open up expansive visions of multiple alternative futures. These articulations can readily provoke fears and desires, alongside embodied [13, 102] and visceral [52] future imaginaries that can productively disrupt perceptions of everyday realities [11]. Through a range of experiential presentation formats, these evocative representations can further be used to encourage more political discussions across established and emerging publics [43] on the often ill-conceived consequences of technology use for wider society [49]. Despite this disruptive, political and transformative potential, many have argued that the power of these remain in the language of designers and experts [7, 38, 67] or discursive rather than experiential [49]. While presentations of the developed futures by designers are often made public and shared beyond design studios [45], audiences that are reached can often share similar values familiar with reading and engaging with future worlds presented by expert designers. Rarely do these

discussions engage affected communities or create on-the-ground change, by working between the intersection of government services [28], policy [95] and grassroots communities [10]. Approaches focused on celebrating hyperreal versions of reality like speculative design, act as critiques of the technology industry, which can be valuable. However they also start from the position that the individual is a free agent who can make up their mind, to generate a plethora of micro utopias [49]. This neoliberal fantasy, however makes it unclear of how designers engage methodologically and more pragmatically and politically, to respond and address systemic social issues at a community scale.

Participatory design has however engaged in these discussions since its conception through e.g., future and situated workshops, town hall meetings, dingpolitic [79], and infrastructuring [108]. Provocation has been explored in PD to problematise design and research objectives [22] as well as to question broader socio-technical and cultural configurations [41], and to suggest alternative interpretations and possibilities [63]. Recent PD literature has raised issues of methodological fit for engendering participation with diverse communities [75] rather than focusing on long-term sustained outcomes [117]. There have also been concerns about revitalising participation to innovate on PD approaches for addressing big issues and challenges to ensure designers support empowering political outcomes [6] as early PD interventions previously aimed to do [7, 21, 51]. Others argue, the focus of PD should be on scale and reach of learning for and with participants [62]. With this in mind, Gooch et. al point to key challenges of using PD at urban scale, drawing attention to collaboratively codesigning the city and the increased use of technology to gather dialogues and ideas [58]. Gooch et. al [58], citing Gidlund [57], further highlight the lack of clear processes for undertaking citizen driven activities in urban space and suggest outcomes are hard to determine amongst diverse stakeholders, and note the importance of amplifying quiet voices.

Many have argued however that a significant challenge for PD is how projects remain in the here and now and how designers have limited concern on sustaining relationships after specific projects [21, 74]. In more sustained projects to support such diversity some have argued for a constellation of participatory activities to support engagement within urban neighbourhoods to engender long-term community change [10]. These indicate recent calls for revitalizing methodologies in PD to respond to complex societal challenges [6] and anticipating the changing role of the researcher [63] to longitudinally support urban communities, projects and relationships.

## 2.1 Participatory Speculative Design; an egalitarian approach?

Participatory design research has predominantly foregrounded the situated, social and material embeddedness of design practice [44] even during speculation and provocation [37, 65]. More recently participative approaches in speculative design that aim to disrupt the perceived privilege and rhetoric of speculative design and its constituents [9, 80, 89] have explored its experiential [18, 109] and situated [115] qualities. Research in this space embraces speculation not just as the crafted skill of expert designers [4], but shift attention towards real life concerns and everyday contexts [22, 39], as collectively negotiated and contested imaginaries [25, 84]. One

such example within this intersection is the exploration of using fiction to reimagine sustainable DIY practices - embodied experiences of DIY making [114]. Wakkary et. al uses other successful or fictional works as visions to influence the practices of the green-DIY community, asking them to reproduce the idea in a different scale and through radically different means [114]. This reinterpretation inspires community action through the element of design fictions by creating their own versions of the concept. In particular, non-designers are engaged through the practices of active and collective making [116] of speculative futures through the arts and creative media [1, 103], suggesting political agentive potential for embracing pluralistic visions and confronting historical oppressive narratives and limiting representations [9, 20]. The value of such approaches are important for groups and individuals who can often be marginalised and excluded from mainstream interaction design [55, 113]. Participatory speculative design can, therefore, be considered as more of an integrative approach to achieving embedded and ethical political action [81].

Participatory speculative approaches, however, also need to be developed with care. Research has highlighted the need to pay attention to how particular environments (including props, materials and approaches to facilitation) [3] frame speculation and participation as a provisional and fragile practice [18, 52]. Particularly when working collectively with groups who are considered marginalised or politically inclined. Further to this, differing agendas and expertise in practices of participation can unwittingly steer agendas through scenarios or material resources [24, 53]. Participatory speculative design can also require a significant investment of people's time, as well as forums for public collective debate [12] involving a longitudinal multi-generational process to ensure a diversity of perspectives and extended timescales for actions [56]. We take these challenges and considerations into account for engaging the community in our workshops discussed in the following sections.

## 3 BACKGROUND OF THE PROJECT

We worked with a neighbourhood in England which has a number of active citizen initiatives. Engagement with the neighbourhood began at the end of 2015 as part of a pilot-scale citizen science project designed in response to concerns raised by the community regarding the effects of traffic pollution on the quality and safety of edible plants grown in front gardens. Another project that sought to map air quality using regular foliage samples taken from mint plants hosted by participants in the neighbourhood finished in March 2017.

The research we focus on in the paper was proposed in December of 2017 with a view to move away from specific technology solutions to explore some of the more complex socio-cultural characteristics of relationships developed during earlier projects. Workshops were drafted when the director of 'Grow-in Containers' (pseudonym), a local micro-business contacted our research team in early 2018, interested to collaborate on alternative ways to envision future opportunities and explore uses of technology within the community to support more self-organised activity. This directed the focus of the research towards answering: *How can participatory approaches engage grassroots communities meaningfully*

*and collectively to think about sustainable futures for urban food growing?*

### 3.1 Food growing context within the neighbourhood

Many residents in the neighbourhood live in renovated 19th-century terraced houses and flats with limited growing space and limited sunlight. Some residents grow plants in small walled front entrances and concrete backyards that lead onto communal back lanes. The neighbourhood is located alongside a large public park which has a community orchard, and fenced garden used for communal food growing next to allotments. Residents are multi-ethnic with many originating from South Asia, the Middle East, Africa, and Eastern Europe. This diversity is reflected in local food shops on the high street adjacent to many of the houses.

Some of the residents we spoke to are increasingly concerned about food sovereignty and food miles alongside families experiencing food poverty and malnutrition, who access resources such as local food banks. There are many different community organisations operating within the neighbourhood. One of these is 'Green South' (pseudonym), which describes itself as a movement to empower residents in the area to bring about positive change. Green South is involved in many environmental initiatives including maintaining the public park, local food growing schemes including local micro-businesses, litter picking, community events, fundraising, and knowledge exchange, while keeping people informed through a local magazine, Facebook page and website.

There were many different ways that people in the neighbourhood were involved in local food growing. These included micro-businesses, allotment growers, community organisers and professionals, park and community garden volunteers, small third-sector organisations (e.g. women's centres) involved in growing food for healing and skills exchange, local schools and people within the larger neighbourhood attending public events where they were invited to plant seeds and try local food growing. Participation in these different schemes was predominantly volunteer-driven or part of a time banking scheme where taking part in food growing activity was used as a means of exchange for other services available in the community (e.g. having your hair cut or learning carpentry skills).

More recently, however, there have been significant funding cuts where projects and infrastructure have been taken away due to austerity measures and project-specific funding from large funded projects coming to an end. This has also coincided with the closure of a local allotment site. Members continued to share tips and tricks, seeds, excess produce, equipment, recipes, preserves and prepared food, during face to face community meetups. Due to negligible funds, they moved to self-organise through the use of social media, emails, word-of-mouth and flyers to inform people about the events and to stay connected, share queries and videos. For example, a micro-business, "Grow-in Containers" was a part of a larger Green South project between 2013-18. After the funding cuts, they decided to continue with a program of small scale events including knowledge sharing and food growing meetups supported by a core volunteer group. Unsurprisingly, many residents were unhappy with funding cuts. Members voiced concerns

regarding the challenges of access to infrastructure, limited financial resources, council support, growing space, uncertainty about growing food, wider engagement in the area, and time constraints as key challenges in their endeavour.

## 4 EXPERIMENTS IN LIVING

Our methodological approach was informed by recent work that describes sustainability research in the context of living experiments [87]. Marres describes the living experiment as a notable device of social and cultural research since "it provides a format or 'protocol' for exploring and testing forms of [social] life [...] [the experiment] can be used to explore collective practices of researching social and cultural change, as engaged in by actors who do not necessarily identify themselves as 'social researchers'" [87]. Moving away from the experiment as a site where controlled variables can validate hypotheses, this approach was more aligned with research 'in the wild' [31] or 'living lab' [16] where socio-technical or design interventions are staged to intervene in everyday life as a site for applying situated methods that infrastructure alternative forms of knowledge. Research by Liu et al. further describes 'the wild' as one of humanity's earliest labs focusing on the farm and earth systems [83]. Experiments like soil optimisation, seed hybridisation and creative recycling are examples of processes carried out in natureculture [64] which come with considerable knowledge and technical vocabulary [83]. They credit grassroots communities, for inventing and testing practices that blend technological, biological and agricultural knowledge. It is through these sensibilities of grassroots community experimentation that our methodological approach was developed. These PSD approaches were developed in conversation with the everyday experiments in living already taking place within the community. We used speculative methods to bring into dialogue the taken for granted tacit knowledge shared within the community and how they connected with the wider local, national, global environmental concerns and future uncertainties. Speculation was therefore both situated in place while extending to wider concerns and longer time-frames to extend our collective understanding of community values and action on food growing.

### 4.1 Workshop delivery and format

Each workshop had a slightly different focus and form of delivery. Workshop 1 focused on mapping growing spaces in the neighbourhood. Workshop 2 focused on walking and experiencing growing spaces in the neighbourhood. In Workshop 3 we designed and played a growing futures game and in workshop 4 we crafted alternative growing worlds on a new planet. Each workshop was designed through a reflective iterative process by adapting speculative design to be re-rooted in participatory ethos, in an attempt to make design speculation more egalitarian. The different modalities of speculation used in the series were defined after concluding the workshops like an analytical structure to better characterise and simplify what we were trying to achieve in each session. Where subsequent workshops were informed and designed by outcomes arising from each prior workshop. For example insights from the first workshop where we mapped community growing spaces informed areas we should visit on the walk we took on the second workshop. Insights from the second workshop informed the design

	W1	W2	W3	W4
	Mapping	Walking	Gaming	Making
No. of Participants	8	8	7	3
Returning Participants	-	5	4	3
Mode	Invite	Situate	Deliberate	Craft
Activity	Hand Drawn Cardboard Map of the neighbourhood with Prompt Cards and crafting material	Walk of the neighbourhood with Fictional Scenarios mapped to specific locations	Board Game of speculative future lands played with a Card Deck - Beasts of opportunities and concerns	Crafted 3D models of the new world made out of recycled material in response to Fictional Scenario
Speculative Tropes	Prompt Cards Draw your future Garden. Where would you like to grow food in the neighbourhood	Fictional Scenarios Residential Street - "People in the neighbourhood now get 25 percent of their food from sharing with others. How do they co-ordinate this?"  Backlanes - "The neighbourhood has won an award from Grow Your Own magazine for best innovative green food growing community. How do you think this came into being? etc.	Board & Card Deck Fictional Future Lands - Land of Climate Change, Land of Brexit, Land of Robotic Farmers etc.  Beast of Opportunities - Hare of Intergenerational Exchange, Owl of Knowledge, etc  Beast of Concerns - Whale of Activity, Magpie of Community, etc	Fictional Scenario Invitation from British Interplanetary Society, to visit and build infrastructures conducive for growing on a parallel planet Earth X
Data Analysis	Responses on prompt cards and geographical areas of interest and concerns raised on the map. Through field notes, transcription and video data.	Audio and video data was open coded later performed axial coding to consolidate emerging themes as inspiration. Highlighting values, fears and hopes associated with growing	Audio and video data was open coded later performed axial coding to consolidate emerging themes as inspiration. Highlighting fears and dystopias associated with future	
Influence on next workshop	Develop a mapping exercise - inform route for the walk and develop issues as fictional scenarios to be discussed at locations	Particularities of place and the different actors involved in constraining or creating opportunities for food growing provided inspiration for the game design and the card deck.	Key themes used as value signposts for future worlds and building activities. The fictional scenario was also developed to move beyond w3's socio-political complexities	
Context	Individual	Neighbourhood	Larger social and political context	Community context (in a new world)

Figure 1: An overview of workshop series.

of the game for the third workshop. Finally insights from the game fed into the final workshop to build an alternative future growing world.

## 4.2 Researcher reflexivity

Ongoing engagement, within the neighbourhood continues and is currently driven by the first author of the paper who is an active member of the Grow-in Containers and Green South communities. The second author lives within the neighbourhood, engages with Green South activities and is closely involved with the food growing community giving the researchers exclusive access, reliability, and convenient recruitment of participants. The third author has had a continued relationship with Green South since 2015. The authors align themselves with social justice and environmental citizen-led movements driven through grassroots and feminist perspectives to challenge top-down and techno-solutionist narratives of sustainability.

Prior to and during the workshops, some of the authors attended additional community events including tree pruning, film nights, meetings on volunteering and funding, celebrating harvest, planning for the summer, seed and plant sharing, making preserves, seed saving, food miles and carbon footprint awareness. These events

were held as street sessions, in the backyards of private homes, and attracted a social, cultural, and ethnically diverse group of people, such as teenagers and families, and those self-identifying as being of British, Pakistani, Indian, Bangladeshi, Mexican, Polish, Swedish, Jewish and Nigerian heritage. These informal long-term engagements shed light on community dynamics, the spatial negotiations within the neighbourhood around available land for food growing, and subsequent decisions around growing practices, to build opportunities for diverse forms of inclusive engagement within the neighbourhood. The researcher involvement and reflexivity within the field played an important role in devising the activities for each workshop as ongoing relationships with participants and the neighbourhood played an important role in understanding the socio-material aspects over time.

## 4.3 Recruitment

While the research is part of a long-term engagement the paper focuses on four workshops taking place between March and June 2018 with a closing interview with the director of Grow-in Containers in July 2018.

Workshops took place in the local community centre and garden, and participants for the workshop were recruited using word of

mouth invites and posters put up in the neighbourhood and the community centre. The posters advertised a food growing hands-on skill-sharing session followed by a creative workshop with free seeds and lunch. This was to attract a diverse group of participants in the neighbourhood who were interested in food growing practices and would like to learn a new skill.

Workshops were scheduled in the middle of the day, 12 pm - 3 pm due to research team scheduling, availability of the venue, and to attract people with childcare responsibilities. This unfortunately often meant limited participation in comparison to evening events organised by Grow-in Containers. We therefore designed them to be drop-ins where people were free to walk in and leave at any given point and would last 3-4 hours. The director of Grow-in Containers, John (anonymised), is an influential figure within the food growing community and was asked to act as the gatekeeper for recruitment and facilitate skill-sharing sessions as a precursor for each workshop. He joined the workshops to facilitate these more practical skill-sharing elements and as a member of the community to add to the discussions in the future thinking. The skill-sharing sessions included, planning your garden, what to plant every month over the year, and composting and wormeries.

The workshops and skill-sharing sessions saw attendance from 14 different people in total, from different ethnic backgrounds, between the age of 25-70 years, who were part of the existing food growing community or were interested in urban food growing. A large proportion of the food growing community are predominantly white and retired, which has been a rising concern within the community. The representation within the workshops was affected by this fact and saw only a few people within the young middle-aged bracket and of different ethnicity. Each workshop had between 3-8 participants with equal gender distribution, included novice to expert growers, and there were 3 members who attended every workshop.

#### 4.4 Data collection and analysis

After collecting written consent, each workshop was audio and video recorded and photographs were taken to document, for example, visual materials produced by the participants like maps, drawings, handwritten notes and crafted 3D models. This was also supported with field notes, observations and researcher reflections. Participants were assigned pseudonyms to preserve anonymity. Video data was annotated specifically where community members speculated about futures.

The data has been iteratively analysed at different stages of the project. During the course of the workshops, researcher notes and reflections were used in the design and development of each subsequent workshop. In *workshop 1* the research team read responses from the postcards and fieldnotes to map geographical areas of interest and concerns raised through the participatory mapping exercise to inform the route for the walk in *Workshop 2*. Audio and video data from *workshop 2* was openly coded independently by the second and fourth authors after initial transcription. These initial open codes were then brought together and researchers performed an axial coding to consolidate emerging themes as inspiration for the following workshop. This preliminary two stage analysis highlighted values, fears and hopes associated with growing in relation

to the particularities of place and the different actors involved in constraining or creating opportunities for food growing within the community and provided inspiration for the game design in *workshop 3*. *Workshop 3* was similarly analysed with key themes developed as signposts for future worlds and building activities in *workshop 4*. The same analytical approach was applied to *workshop 4* to gain insight for a reflective interview with John at Grow-in Containers.

Once workshops and the interview were complete, a narrative analysis was conducted by the first author and calibrated through discussions with the second and third author, which involved placing all data in a chronological sequence including photographs, transcripts, video annotations and notes. [54]. Following a close reading of the data from each workshop, significant events where participants speculated about the future were highlighted. Further detail of the wider context of the speculation, who was part of the speculation, what emerged before and how these ideas were later expanded on by others or dismissed were pulled out for closer analysis. These episodes were represented in diagrammatic form to highlight chronological and semantic relationships between them. The diagrammatic representation of the workshops and the themes were then written into a narrative account to recreate an interpretative rendition of important moments of speculation from each workshop as presented in the next section.

## 5 WORKSHOP DESIGNS AND FINDINGS

In this section we describe the design of, and findings from our experiences of conducting a series of four PSD workshops designed for engaging the community in creative exploration of futures of food growing in their neighbourhood. Each section represents a prominent narrative that surfaced in our analysis, and corresponds to one of the four workshops. We also discuss each workshop in form of different modes: invite, situate, deliberate and craft that emerged through the process of organising them. In the figure below (Figure 1) we also provide an overview of the workshops, the number of participants and how each one influenced the next.

### 5.1 The map: creating common ground

The first workshop (W1) included a mapping exercise which was designed as an *invitation* [82] to allow local knowledge to surface, and to challenge researcher and participant assumptions and expectations about the community and the project, respectively. Therefore the mode of the workshop was to invite co-creation, acknowledging that collaborative activities and speculation can sometimes be uncomfortably demanding, we envisioned the map as a space for enabling participants to share and negotiate points of interest, perspectives, and values. This was partly to ease participants into potentially more demanding ways of thinking about the future in later workshops. The activity was therefore focused on capturing local understandings of place and belonging in the neighbourhood in relation to food growing, inspired by participatory mapping methods [34]. It involved populating a sketched geographical cardboard map which only included some key landmarks, and responding to prompt card questions. This was purposely sparse to leave it open for participants to add their own places of significance and elicit different understandings of 'place' [66] with respect to food.



**Figure 2: Left to Right: Skill sharing session: plan your garden, Shared seed packs, Map with pasted prompt cards, Various written cards, Drawings of present and future gardens, Crafted raised bed by Rebecca**

Eight people attended this first workshop and the initial drawing and crafting in the mapping exercise made it easy for them to respond to specific questions about growing practices by representing current and future gardens. However, discussions about places to grow food or not to grow food beyond individual council planters and backlanes which were often filled with rubbish. Some participants felt they couldn't possibly grow food in these public spaces, but Rebecca one of the more seasoned growers, believed otherwise and linked the local council planters to the need for more communal spaces due to the recent closure of the local allotment site. She expressed frustration during the workshop, showcasing on the map where the site was located, while describing her political contestations about their removal.

These expressions of frustration and concern over the taking away of the growing land was captured through her crafting of a raised bed on the map, alongside discussions about the history of the local allotment site. The process of making and mapping the raised bed symbolised a number of geographical sites for her and the wider community's aspirations for growing and a sense of catharsis for the loss of the allotment site through the use of matchsticks and used tea leaves. She told the researchers to delay wrapping up the workshop to complete it and once finished she asked everyone to plant something in the miniature raised bed, "It's a community garden we all need to plant something in the garden now. Do you want to add something? A watering can maybe or bean shoots if you can manage". See (Figure 2).

Throughout this process, participants presented themselves as expert knowledge bearers, inviting us as researchers and novice growers into the community through sharing. The design of the workshop activities and materials enabled the participants to draw on their food growing experience, and fill gaps in the collective knowledge about the neighbourhood. The positioning of the researchers, as largely unfamiliar and non-expert in the setting and practices, emphasised the expertise of the participants and invited participation on these grounds. In doing so, the mapping exercise created information, knowledge, cultural and creative commons

[72]. Becoming a safe space to accommodate varying points of view, expressions and opinions, even challenging the researchers assumptions of the neighbourhood and highlighting particular areas of complexity for communal food growing that we hadn't anticipated. These were to do with the peculiarities of how everyday practices and ideas of place were (re)negotiated within the neighbourhood by the food growing community, and we tried to further unpack and explore them in subsequent workshops.

## 5.2 Situated speculation: redefining the everyday

In the second workshop (W2) we focused on situating speculation within specific sites of special interest highlighted in the mapping workshop. After looking at the populated map and its material artefacts we devised a speculative walk, in a mode to situate the speculation. Taking inspiration from walking methods [112], while also incorporating fictional scenarios like Stals et. al [107]. These were related to specific places highlighted by residents as existing or potential new social spaces for growing food. We identified 6 areas including residential streets, back lanes, an abandoned hospital and local grocery stores.

We devised situated fictional scenarios as a way to suspend belief about what was possible while keeping long-term values of the community intact through the chosen sites. This was to encourage critical reflection on the existing configurations of food growing spaces in the neighbourhood. The scenarios created were based on themes emerging from W1 like limited growing spaces. Each scenario was developed by the research team through a desk survey of recent news articles and other successful and more speculative food growing projects. Images were collected from these projects as future visions to help facilitate the workshop discussions. Example scenarios included: "People in the neighbourhood now get 25 percent of their food from sharing with others. How do they co-ordinate this?" another such instance, "The government introduces high taxes on meat and dairy products to mitigate harmful climate change. A higher demand for fruit and vegetables means that the prices of these also rise. How have people in the neighbourhood responded?"



**Figure 3: Left to right: Researchers discussing the route for the walk, Articles and projects on the wall being discussed, Group during the walk, Discussion of a fictional scenario, Reimagining council planter and backlanes**

The second had 8 participants out of which 5 had attended W1. The workshop began with discussing the wall mounted printouts of collected visionary projects and news articles while eating lunch. Potential locations to be visited during the walk were discussed and a route was devised collectively. One area that was mentioned included the back lanes which triggered some unease around issues of litter.

As we walked with the participants, we asked them to think of the following questions 1) *Can you spot where food is being grown now?* 2) *Where could food be grown in the future?* 3) *What would need to happen for food to be grown here?* 4) *Is there a magical thing (tool, device, material that does not exist) that you could use to help you?* See (Figure 3).

Walking in small groups, we discussed with residents their relationship with the neighbourhood and its history, which highlighted a sense of pride and belonging. The group walked towards a popular residential street well known for its food growing endeavours and began by observing what was already growing in concrete spaces, pots and small front gardens, the engagement heightened through embodied actions like touching, pointing and tasting with excited discussions about which plants were edible. John jump-started the process reinterpreting the space by suggesting alternative use and plants for the roadside council planters.

John: Gosh, what could you grow there? [...] like perennial veg, herbs or vegetables, which you don't have to plant every year. So you could grow things like erm raspberries or blueberries, strawberries or herbs like bay and rosemary and sage [...]

Rick: One of the things we talked about, these would be great as just community herb gardens where people could come out and pick some herbs and whatever they need.

John: [...] And... it's actually, although you can go and pick it in the woods, actually if you had it on the street, if you can just pop it outside your front door, pick a few leaves, it's very healthy, it's very good for you.

However, discussing the planters, issues such as austerity and who's responsible for managing them also surfaced wider conflicts and tensions, bringing out opposing values about sharing food. For example, the fact many residential front yards were open and accessible was a positive for John but was a concern for others,

Molly: [...] growing outside your house here erm every passer-by could help themselves if they so choose [...]

Sabrina: So there needs to be an understanding that food that are grown close to the house primarily belongs to the person living there and growing the food. That needs to be established well within the community [...]

Rick: It's enforcement

Similarly, contested public spaces like the backlanes were linked to ongoing negative experiences of littering. However, the fictional scenario "The neighbourhood has won an award from Grow Your Own magazine for best innovative green food growing community" gave John a window of opportunity to push the boundaries of the discussion, inspiring others to think positively and break away from concerns. He extrapolated existing technologies such as solar panels, reflectors, growing lights and food growing solutions to create alternate imaginings.

John: Well what you could do is erm you could make a sort of big polytunnel couldn't you, the walls painted white to reflect the light in, but also put heat back in...

Marta: Oh, you mean the polytunnel over the lane?

John: [You could funnel] the extra heating from the houses into the thing and you could take the [rain] water from the roof [to water the food growing inside... and] put massive great raised beds on the concrete [lane].

Molly: It would need a lot of committed children!

Situated speculation, in the context of the walk and the fictional scenarios, allowed for a redefinition of the everyday rather than encouraging diverse alternatives. Residents often found it difficult to imagine creatively and collectively beyond what was already present. For some, imagined alternatives often evoked fear and disgust, even when generative possibilities were introduced. In this way, rather than providing an entry point or context for speculation, the situated and the everyday prompted the critical questioning of possibilities. Everyday concerns about the practicalities of successfully implementing the suggested alternatives negatively affected the distance we hoped the fictional scenarios would provide from the perceived limitations of growing in the neighbourhood.

### 5.3 Agonistic speculation: experiences of disempowerment

For workshop three (W3) the researchers focused on opportunities for speculative deliberation by creating a game to try and provide some distance from the issues discussed during the walk. The researchers thought by changing the scale of the speculation and situating it beyond the neighbourhood can inspire new thinking in participants. The research team began by analysing the previous workshop, drawing out concerns, fears, hopes and values of the community. Our aim was to create a mode of deliberation to break away from existing social and spatial realities, and shift the framings of the fictional provocations away from problems to solve, which often led to solutionism. Taking inspiration from recent work on developing and using games in design workshops [19] and Coulton et. al's idea of games to introduce more playful conversations and flatten hierarchies [35] we designed a board game for futuring. Designed as a turn-based race game arranged into future lands that the team created based on the analysis of the data from W2. Lands were characterised by things like the use of robots, Brexit, and climate change, and their descriptions ranged from probable, plausible and possible futures relative to the lived realities of the neighbourhood described by participants.

The game play proceeded as follows: each player chooses a token to represent themselves on the board. Player tokens included things like jars of herbs and spices, stones, and seeds. During a player's turn they roll a dice to determine how many steps they move forward on the board. When a player arrives at a land for the first time, they read its description to the group and the group then describe and discuss together what growing food in this land would be like. To further scaffold critical thinking about the land, the board is populated with *beasts*, which can be either positive or negative influences on life in the land. Few square on the board are coloured purple or orange to indicate a positive *beast of opportunity* or a negative *beast of concern*, respectively. We designed a deck of cards for both beast categories. When a player lands on a coloured square they must pick a beast card from the corresponding deck and read the card to the group before speculating how the beast might have an impact on food growing in the land.

We created the beast cards (Figure 4) to reflect values or challenges expressed by participants, and further associating them with specific animals or insects. For each beast, we described both its

abilities and its weaknesses, representing dimensions to be considered with respect to its existence or mitigation in a given land. For example,

#### **The Aphid of Competition:**

Ability - promote economic competitiveness, maximise use of natural resources and spread social inequality

Vulnerability - sharing, altruism and regard for the welfare of others and the environment

#### **Hare of Intergenerational Exchange:**

Ability - highlight respect for different age groups and their different abilities

Vulnerability - people live in silos and only do things within their own age group.

Workshop 3 was attended by 7 people out of which 4 were returning participants. We played the game on a table in the community garden with participants sitting around it (See Figure 4). We wrote down the main discussion points on post-it notes and placed them on the board itself around the land being discussed.

On starting the game, discussion automatically led to high emotions and strong opinions. Rick landed on the Land of Brexit on his first turn. As this strongly related to the current political reality, this led to intense political debate around socialist and communist governments and dictatorships, and what it would be like to live and grow food after Brexit. Given that all participants indicated that they perceived Brexit as negative and damaging, speculations about a future beyond it were similarly framed:

Rebecca: [...] migrant workers aren't coming here because the pay's not as good, because the pound is not as strong [...]

Rick: Automation will happen if they haven't got people to pick, they'll have no choice but to go to automation [...]

Martha: They can pay students to pick the strawberries and pay them a good price.

We found it difficult to navigate discussions beyond political opinions. We tried to suggest counterpoints and stimulate alternative directions for thinking about the future by proposing more positive future scenarios but these were not very well engaged with by participants, often refuted using familiar concepts and arguments like drawing parallels with historical events and personal memories. Land of Climate Change, for instance, brought about fear of refugees, migration, survival and a constant threat to land access, which mirrored perceived causes of the current austerity being experienced in the neighbourhood. When presented with the "*Aphid of Competition*" (Beast of Concern) in a scenario of economic competitiveness, Rick dominated the discussion, shutting down other peoples' ideas while using a historical reference to "*dig for victory*" in World War 2 to argue potential harmful consequences of Brexit on the agricultural land and the price of food in the UK, "[...] before the end of the war the yields were going down greatly because the soil was basically shot in a lot of areas [...] it was just totally infertile [...] If your natural yields are going down, if the land's not



**Figure 4: Left to right: The futuring board game; Some Beast of Opportunity and Beast of Concern cards; Skill sharing session and participants playing the game.**

*properly managed, the prices are just going to escalate. [...] It's going to cause even more division, you can have more haves and have nots."*

When participants came to the Land of Robots, however, ideas of robotic farmers provided some comfort, associated with efficiency and a bright future by reinterpreting technology to existing values and motivations associated with food growing practice. Technology wasn't perceived as political in the way that Brexit was, and so the Land of Robots provided new space for speculation. It was proposed that the use of robots could help grow food without chemicals, enhance yield, help farmers with more leisure time and manage soil. Robots were also compared to the functionality of a dishwasher, while also recognising their potential limits and the ongoing role of people: *"the machine is only as good as the programmer"* (Dan). Some believed the availability of inexpensive robots would also end up deskilling people. The opportunity card, "Hare of Intergenerational Exchange", did bring in an opportunity for positive reflection after the fear of deskilling was brought up. Rick explained, *"One of the things maybe with the robotic farming is, if you're on it, at the same time you're passing on intergenerational skills. Maybe that has got to be only a certain maximum amount of robotic farming [is allowed], and so much manual [farming], purely so the skills aren't lost. So let's say you're allowed to do a maximum of 75% on your land, robotic farming, but the last 25% must be manual for to preserve the skill, if that makes sense."*

Just before wrapping up the game we asked for feedback from the participants about the negative associations with the futures discussed. They pointed out that the Land of Brexit was too close to a reality that they did not vote for and when positioned at the beginning of the game, affected the mood and general direction of discussion in the rest of the workshop. Rick said *"The tone was negative. To suspend belief, you want to be removed from reality."* Marta also highlighted how her social and political position made it difficult for her to be positive about the future.

The game was an intense and emotional experience, both for the participants and the researchers. For us, it was difficult to encourage speculation that was not limited by everyday realities and to avoid the discussion being consumed by the exchange of political worldviews. In one sense, the game was successful in distancing the participants from the specific spatiality of the neighbourhood

through the introduction of fictional future geographies and speculative political climates. However, the macro-level refocus on challenges like sustainability, diversity, and national and global politics which limited opportunities for speculation. The scale and uncertainty associated with macro events like Brexit and climate change evoked anxieties and feelings of a lack of agency, which meant that they were also often difficult to meaningfully relate to community-shaped futures of the neighbourhood. As a result, participants felt disempowered and disengaged with the idea of speculating about them and instead exchanged their current views and opinions on the matters. And so, while gamification of macro-level lands as a form of agonistic speculative deliberation successfully created distance from existing assumptions and limitations of place, it also created distance in terms of agency in shaping the future of everyday life in the neighbourhood.

#### 5.4 Speculative making: building on diverse expertise

In the fourth and final workshop we decided to try speculation using material making which built on narratives and values of growing that underlined the vast knowledge and expertise of the community. With reflections and feedback from W3 we focused on an embodied and experiential outcome rather than just critical deliberation. Using our learning from W1 with craft and its connections to embodied growing practices, we explored the mode of crafting by drawing inspiration from Andersen et. al's Magic Machines approach [2]. We further situated our approach within Heideingsfelder et. al's idea of 'participatory design fictions' made by laypeople to give shape to societal needs and perspectives, [68, 69]

We decided to create a worldbuilding [36] task, asking the community to be part of the genesis of a new food growing planet. The scenario was designed as an invitation letter building on the positive experiences and skills of the community as expert knowledge bearers of food growing. The letter addressed to the community members from the British Interplanetary Society, to visit and build infrastructures conducive for growing: *[...] We are writing to you to inform that you have been chosen to be the first inhabitants of this parallel planet Earth X where you will set the groundwork for future human societies. The environmental conditions on Earth X are identical to your area. We've chosen you because of your pioneering expertise in community growing, community engagement, innovation*



**Figure 5: Left to right: Soup prepared by a participant, Visit to the community garden, reading of the invitation letter, Various recycled and craft material made available, Various crafted future worlds by participants**

*and your collective vision for prosperous and harmonious urban living [...]*

The participants were invited to conceptualise and build a 3-dimensional world using a range of materials including cardboard boxes, plasticine, straw, small plastic figurines and animals, plastic bottles, cans, other craft materials and other natural found materials like feathers, sticks, stones, mud and leaves. Using these the participants were encouraged to tangibly represent their future visions alongside desirable community values expressed in prior workshops. These values were written on wooden sticks, for people to use as signposts or motivators for their worlds, such as trust, festivities, intelligence, re-use, beauty, wisdom, sharing, diversity (Figure 5).

The workshop had fewer attendees than previous workshops with *only 3 people joined and everyone returning from the previous workshops*. Each participant was handed invitation letters enclosed in a sealed envelope. John offered to read the letter aloud to the group as an act of invitation and instructions for how to start the activity. Materials to be used for the making of the 3D worlds were laid out on the table for people to select and pick up, to start worldbuilding. Participants worked individually initially given a cardboard box and asked to choose predefined values or create new ones before starting to build their new worlds based on these. While building their individual worlds, the participants talked to each other, took inspiration from one another, and discussed things like family, religion, and their in-progress worlds.

The opening of individual letters and reading them out aloud made people smile and laugh, and created an *invitation* [82] to momentarily leave present reality and challenges in the community and travel to a new place. This workshop had a sense of familiarity, comfort and ease, due to the developed relationship, familiar faces, limited numbers of participants, since each person had been to a prior workshop and also seemed more comfortable with the speculation process. This helped in expressing values more freely without immediate negotiations, sharing, talking and questioning each other and was replaced by a process of taking inspiration from each other to develop their worlds.

Technology featured here as a means of automating rituals, sharing knowledge, managing the land and to help maintain equitable ecological governance. Most narratives indicated a place less characterised by difficulties and problems, and more with sharing, desires and wonders. For example, Rebecca elaborated on an existing pagan ritual she used in collecting moonwater for her plants that she wanted to automate with robots. John created a scene with soldiers, which Rebecca thought was a reflection on the (neighbourhood) allotment wars but he explained these were part of a rehabilitation growing centre for violent people. He also built an intergalactic internet device for sharing seeds and food growing knowledge with others from different planets.

The materials selected to build the worlds showcased the values chosen by the participants at the beginning and the desire to take materials from the present reality with them for the purpose of growing. For example, Rebecca's world was based on wisdom and re-use, used recyclable materials such as milk cartons and aluminium foil containers. She also decided to take plastic as a shared currency: *"Can't produce plastic anymore because we've got enough to just keep going forever now [...] the plastic stuff on here is not from this world. It's come from the old world because we've got enough plastic, we don't need to make any more. So we never run out, we just keep reusing it. Their own bank of plastic .. share it with people who haven't got enough. So it's all, community sharing, no one's owning anything."*

An essential part of these new worlds was technology, with its capacity for wonders but still embedded in everyday food growing practices. For example, Clara, a young mother and a novice grower, wanted a *"dandelion zapper"*, made to pull out dandelions from her land, yet it quickly turned obsolete as she suggested innovative uses of the weed: *"well it would be very spot active, you know. It would be like... it might be some sort of being that just go down on the big dandelion and go shluurp woosh. And just zap them all up [...] Well actually dandelion wine is supposed to be a complete cure. [...] A weed is just a weed because it's growing in the wrong place. And dandelions are quite attractive and, you know, obviously there is value in there, the nutritional point of view [...] Yeah it is rather surprising in a way that like, you know, we haven't developed some sort of industries to do dandelions because they're so resilient. You*

*know, obviously rabbits and guinea pigs that love them. Maybe we could have a guinea pig farm. Dandelion risotto. It's medicinal."*

Governance was also applied through a careful negotiation and compromise of values via a recognition of loss of plant life inherent in creating growing space for people even in a low-tech, eco-community. Clara, for instance, described the problem of colonisation of the new planet by removing old trees for houses and food growing space. Yet to ensure this was managed sensitively she decided there would be no land ownership or transport. *"you know, we're colonising this world and obviously if it's the same as here then it would have been forest wouldn't it? So we'll have to chop down some really quite big trees unfortunately [...] you don't inherit anything and you live in it while you live in it [...] do away with the concept of land ownership altogether"*

The act of crafting the world, in comparison to conceptual discussion, took away the pressure of dialectic co-speculation allowing more freedom to individually re-imagine ideas on starting afresh to build a utopian futures. However, each created world was also imbued with socio-material values from the neighbourhood and personal growing practices. The use of humour and magic was also repeatedly used to explain their created worlds and objects within them. While participants were challenged in the first three workshops to think beyond their known, and often difficult, reality of urban food-growing, the last workshop used material making to scaffold thinking beyond the present but while still embedded in the practices of growing food. The workshop worked well to open up the possibility of creating a utopian food growing world with community values leaving behind the worries of the everyday.

## 6 DISCUSSION

Recent research in SHCI has called for greater attention to longer time-frames and participatory design practice that enables communities to engage more meaningfully with taking action towards sustainable futures linked to climate change. The use of speculation has emerged in this space, however little attention has been paid to the methodological implications of such work in how HCI research might meaningfully navigate between larger societal concerns and community-based actions. While there has been progress in responding to these concerns through recent research in food growing, limited reflection on the methodological approaches used has created challenges for researchers in the field who are working to enhance their techniques and insights. In our final discussion we synthesise perspectives on the different modes of speculation presented in each of the workshops - invite, situated, deliberate and craft. Here we present four key insights arising from this synthesis, the importance of challenging normativity of scenarios; challenging normative role of the researcher; balancing agency, politics, and deliberation in participatory speculative design; and community driven technology visions. We suggest some ways that these might be put into practice with communities to foster ways of thinking about long-term commitment and alternative futures.

### 6.1 Challenging normativity of scenarios

The neighbourhood food growing community we engaged with during this work has, for some time, been trying to create alternatives and operationalise sustainability values through their food

practices. These values and practices are very much in opposition to mainstream food systems that rely on large scale, intensive monoculture. The everyday experiments in living that take place through food growing within the community, and the subsequent documentation and communication of it, are an attempt to practice, negotiate, and modify everyday habits and habitats through ongoing changes in routines and spaces, while also reaching out to new growers in the neighbourhood.

Our approach followed previous efforts to break away from the status quo that can constrain thinking about futures of food-growing in cities [86]. However, this sometimes seemed to unwittingly replicate and reproduce some of these more normative ways of imagining food futures. We have found it useful to reflect on this challenge with what renowned activist Vandana Shiva refers to as monocultures of the mind [104]. She argues that monocultures are reproduced through dominant systems of knowledge and power, mostly referring to the western scientific knowledge. She highlights that monocultures of the land start first in the mind through the circulation of scientific knowledge and are then transferred to the ground. Monocultures of the mind [104] persist through powerful institutional mechanisms which replace local knowledge, diversity and decentralised control. Shiva argues that monocultures therefore need to be resisted through diversity as a way of life and thought, and the politics of debate and dialogue [104]. This chimes with the development of agnostic public spaces [16, 41] and radical pluralistic democracy [91].

We saw normative reductive ways of thinking as a response to the fictional scenarios developed by us in W2 and the speculative lands in W3. Responses to these scenarios from participants often reflected tropes that were unwittingly designed into these as provocations, such as the cornucopian paradigm where sustainability can be achieved through efficiency gains that limitless technological advances and growth can provide [118] like the suggestion of automation due to scarcity of labour, or sustainability as living with scarcity [92]. Ways of thinking at either extreme can be problematic [60] in conducting speculative ecological work because they can unhelpfully reproduce the kinds of monocultures of the mind that Shiva refers to. In fact, the challenges, and potential ways of addressing them, are more nuanced and varied than these extremes imply. Although we intended the fictional scenarios to be engaging provocations, in some cases they encouraged normative ways of thinking associated with well-rehearsed narratives.

We suggest responding to these normative challenges using two approaches; the first in how existing scenarios are used for speculation in workshops and the second is in diversifying scenarios. In the first instance future research should pay more attention to how speculations are introduced and interrogated by participants to invite more criticality, asking questions about limitations of scenarios, what participants think or feel, or how they could be rewritten rather than asking them to imagine what a future like this would be like.

In the second instance we suggest bringing values and practices from the wider neighbourhood into the design of speculations in co-creative ways to develop scenarios collectively. Most importantly for future research, but particularly relevant for this neighbourhood, was the lack of diverse cultural and ethnic representation. We suggest diversifying speculations used in workshops by engaging with

more culturally diverse participants (e.g., considering the wording and language used in recruitment materials, and positionality of researchers embedded in the community), while actively drawing from and practicing cross-cultural research on sustainability and everyday practices as demonstrated by the rich representations created by [9, 10].

## 6.2 Challenging normative role of the researcher

It is evident that the design of the workshops and the speculative tropes reflect the power held by designers and researchers, where the researcher articulates a perspective rather than being an observer [37]. This reflects a tension experienced by us during this project. On the one hand, we were conscious of prior research that highlights thinking about the future can be overwhelming and takes time to develop for novices. We saw this with returning participants during the workshops who became more comfortable imagining alternative realities as the series went on. On the other hand, we were conscious of being perceived as “experts”, and were careful not to impose our own values on the outcomes of the workshops. It was therefore important to reflect on our positionality before and after each workshop, and the diverse backgrounds of the members of the research team, including different positionalities, our relationships to community members, cultural understandings, connections to the site of inquiry. This helped in creating reflexivity to respond with criticality and care to disrupt any unintended influences we might have had on the workshop outcomes as a result of our roles as researchers.

We see this reflexivity as accentuating our role as an ally [63] opening up the liminal design space between the rigid hierarchy of local government and the growing and innovative scene of grassroots organisations [47]. We suggest HCI researchers should make explicit researcher positionality, integrating this within an active design process and making dedicated scheduled time for collective reflection and articulation with communities. In this project, we reflected between workshops in weekly meetings, we documented what aspects of the activities worked and which ones didn't, and our differing relationships to these issues. This helped reorient our aims for the following workshop and helped us acknowledge the evolving positionality of our role [6, 63], ensuring we were “staying with the trouble” [65]. Therefore participatory speculative methods can try to combine or move attention away from concerns for efficiency and production with care for the environment and alternative food systems. Therby helping structure discussions towards big socio-ecological questions at the level of people's everyday experience.

This slower, careful and patient process reflects the nature of food growing itself. These instances meant, staying with and maintaining curiosity about the conflicts arising within the group when discussing futures, personal politics, mitigating power dynamics, fear and the creation of dystopian ideas. The ongoing reflexivity also helped in the iterative creation and curation of safe spaces for voicing concerns, equity in participation and the impoverished thinking linked to dystopian futures, fear and anxieties. We argue that HCI researchers working in ecological and social sustainability contexts can build community capacity for thinking about the

future through this ongoing negotiated articulation work. We see this highlighted in the next section where we talk about balancing agency, politics and deliberation through our role as a researcher.

## 6.3 Balancing agency, politics, and deliberation in participatory speculative design

Agonistic participation can highlight underlying differences in agendas and power dynamics, particularly when working collectively with groups who are considered marginalised or politically inclined [41]. The board game in W3 opened up the possibility of several different kinds of narratives to be constructed, interpreted and presented by the participants. It required the group to make sense of each land and imagine themselves living and growing food in these specific places as they worked towards an ambiguous future. The sense-making process, as in the case of most speculation, took time. Often the most vocal of the group started talking immediately, often inducing fearful responses. The awkward dynamics of this meant we were challenged when trying to facilitate or introduce new ideas, in an attempt to change the tone and offer alternative interpretations and ways to open up discussion. The lands introduced in the game in W3 were very much based on grand societal narratives of wicked problems, influenced by current affairs (e.g. Brexit / Climate Change). These appeared to induce fear and frustration, which led to ideas being closed down through overpowering conversations or more comfortable well-rehearsed normative tropes were brought forth (e.g. dig for victory in WW2).

Concepts like sustainability and Brexit are also quite abstract and are themselves speculative in nature. This combination appeared to be experienced as disempowering because the actual future significance wasn't quite clear at the level of the neighbourhood and everyday life. In this sense these different modes of speculation using grand societal, national or global narratives, if imposed on the participants, could exacerbate feelings of limited agency affecting imagination, lack of engagement, and limited benefit for the community.

However, in the crafting activity in W4 we used one main narrative which explicitly foregrounded the community's expertise as growers, asking them to speculate through making, later sharing their creation of multiple different kinds of worlds. These were defined through materials and refined through words and descriptions that had come from participants in previous sessions that pointed to more preferable futures. The act of material making also took away the dialectic co-speculation which was the case in other workshops, easing out the creation of new socio-material dimensions and their meanings, in the new perceived life. The embodied and experiential outcomes of the speculation was to capture re-imagining of place through making rather than critical deliberation.

Material making appeared to make it easier for participants to think about the futures more experientially and viscerally. It linked directly back to their practical skills expressed through growing, in turn bridging the *experiential gulf* [29] between the present and the future. Here the physical making was carried out by the participants rather than the designer. Yet the narrative of space travel as introduced in W4, while familiar, also tapped into problematic narratives of the earth's devastation and possible escape to new planets. This prompted ideas of colonial pioneering as discussed by Clara when

she created a new community growing space. The difference however was how crafting this new planet slowed down participants' responses allowing for a readjustment of life and growing to reflect more long-term social and technical governance structures.

Frank (citing Haraway) [54, 64] describes stories as material semiotic companions highlighting that “*good companions take care of one another [...] shaping the other [...] each companion enables the other to be*”(p43). Seen in this sense the speculative stories provided by us in W2 and W3 were not received as companions but were refuted, rejected and challenged. While as researchers we found this difficult in the moments we were negotiating these contestations and frustrations, they were valuable in highlighting that these narratives were not considered to be taking good care of the growers in generous ways and not well aligned with their sensibilities to encourage alternative future imaginings.

With this in mind, engendering particular kinds of agency through rhetorical, artistic, material or literacy devices is important. These devices can establish critical distance beyond a ‘*performed version of the real*’ [59]. They can also bring their own agency for exploring different realities and deliberation of and with others upon the ‘*overarching politics of the real*’ [73]. Therefore, designing in a way that is responsive to where communities position themselves in their own stories and how they are being positioned in new stories is significant for HCI in addressing particular forms of community engagement and speculation for sustainability.

#### 6.4 Community driven technological visions

Visions of the future embody ideologies, norms and priorities often shaped by policy planning, market economies and cultural imaginaries [88]. This is in line with current sustainability research which outlines the interconnectedness of socio-technical systems. Dourish highlights how technologies designed with sustainability in mind necessitate connections with other structures operating at multiple scales across a number of stakeholders and agendas, which can often feel disempowering for communities [46]. These varying scales and perspectives can sometimes lead to problematic framings of sustainability and the design of future technological “solutions”, for example treating sustainability as a challenge of designing interventions for increased efficiency through individual persuasion and behaviour change [26]. Recent calls to action have seen sustainability shift toward practice perspectives [78], long-term considerations, and the need for radical shifts in how to research and design in this space [76]. In this work, our focus has been on community practices.

Community values and the meanings behind everyday community practices are an inherently important facet of imagining future technologies in community contexts. Technology imbued with community values, as discussed by Norton et al. [93], is imperative for building community sociotechnical systems. Our experiences during this project have highlighted the importance of understanding these through engagements with the community so that we could observe and facilitate reflection on them at critical points during the activities involving speculation about the future. This, for example, enabled us to move thinking and discussion beyond the obvious spatial-material conflicts, and normative assumptions that can restrict future imaginaries [88]. Thus, helping HCI researchers

and practitioners to investigate designing for/with communities, concrete futures where sustainable ways of living are embedded with values that are important to the community.

During the walk in W2 for instance, discussion highlighted how existing technologies could be used to repurpose existing spaces. Repurposing is a key value that growers in the community find important when responding to limited space and waste, and framing the challenge of designing public spaces for growing in this way, led to novel ideas and discussions, for example, community champion John’s proposal to use existing technologies like solar panels, soil analysers and monitors to transform the backlanes. During the game in W3 we introduced technology into the fictional lands such as the Land of Robotic Farmers. Speculations here focused on versions of what was already out there, and the idea of an agricultural robot similar to a dishwasher linked the perceived benefit of this technology to time-efficiency and increased production. This also highlighted the growth narrative and fed into the duality in existing narratives of efficiency and productivity, and fears around technologies taking away jobs, de-skilling people, and the loss of local knowledge. However, at the introduction of the opportunity card, *Hare of Intergenerational Exchange*, this helped counter this perception and open up discussions on how the robot could be redesigned to allow for practices of community skill sharing in order to avoid losing expertise about growing food across generations, an aspect that had been discussed in prior workshops. The card therefore acted as a direct call to action representing a shared value in the community that could gently shift the discussion.

This connection between community values and speculative futures and technologies was not something that we could take for granted. W3 introduced concepts like Brexit and climate change that are disconnected in many ways from the scale of the community. The lack of agency at this scale (e.g., for addressing climate change in the community) was reflected in the discussions and speculations about technologies for these lands, focusing more on political narratives and less on community values. When crafting speculations in W4, where the activity was framed around the community being part of the new world, we saw the emergence of the magic technologies which were used for intergalactic seed sharing, more than human governance and intelligent machines to help in food growing practices. While they all seemed like a leap from the mundane everyday, they were still linked to the grounded values, needs and concerns of the community. We saw the discarding and redundancy of technology, like in the case of the dandelion zipper, the values of self-sustenance overtook the need for technology use in creatively looking at the problem of weeds through a more holistic view of food growing that suggested balance and sharing. This is an indication of the possible redundancy of future technologies as is also seen in numerous present or suggested sustainability driven technologies in HCI [26].

Understanding and finding points of connection between the experimental nature of the workshops and the wider community infrastructuring efforts in sustainable living were crucial for highlighting these more nuanced and diverse community-based socio-technical imaginaries. These inevitably brought with them multiple political, social and sustainability considerations including issues of power and governance, vitally important for understanding the potential and limits of technologies. From a methodological point

of view, structuring ways to understand and integrate insights from community practices and their meanings is important to maintain a focus on “community design”. The examples above illustrate how we approached this. In general, however, the longer-term, slow engagement with the community was important in enabling this, including the scope to adapt workshop activities and materials according to insights gained from previous ones. It is also important to acknowledge that socio-technical visions do not stop evolving, and go beyond limitations of interventions and workshops. HCI and the development of future technologies should accommodate these longitudinal considerations for work aimed at designing for sustainability in the context of ecology and community organisations. As seen in our work, it would not have been possible to understand these considerations more fully if the researchers did not have existing relations with the community and the workshops were disconnected from the everyday practices of tinkering [90] and the sustainability ‘experiments in living’ contributing to wider efforts already taking place in the community [87].

## 7 CONCLUSION

While we only ran these workshops over a period of four months, our continued involvement and interactions in the community have made it possible for us to see the ongoing nature of their work. We also continued to go to monthly meet-ups, ran our own growing session, supported sessions on the future plans for Grow-in Containers and organised design projects with students. Also, John had expressed interest in running similar future workshops inviting the larger food growing community in the neighbourhood. We are currently investigating the use of communication technologies for sustaining community practices during the pandemic and co-designing with them socio-technical systems for community led actionable visioning. We argue the evaluation of the outcome is therefore challenging as it is not limited to a discreet project timescale [37] especially when considering sustainable [101] community initiatives[15]. Therefore, we would like to bring to SHCI the need for regular ongoing efforts of tinkering placed in close dialogue with more speculative acts in commensurate ways thereby creating a diversity of possible contested visions, ideas and on-ground action. For the SHCI community, a valuable way forward would be a collective resource, an evolving toolkit of evaluated participatory futuring methods for supporting long-term sustainability action when designing with grassroots community organisations.

As research in sustainable HCI matures and expands, there is an increased need to understand collaborative and participatory approaches for speculation. These approaches are important to challenge normative assumptions about technological efficiencies and functionality to favor sustainability values which promote longevity. We have presented insights on participatory speculative design workshops with an urban growing community engaged in a range of distributed growing and knowledge sharing practices to highlight different modes of speculation in dialogue with community interests and values. These ranged from mapping, walking, gaming and making to invite, situate, deliberate and craft speculations on food growing futures. Our insights show how these different modes both enable and constrain particular articulations of food growing futures and associated technologies that require

negotiation, facilitation and ongoing attention. This includes challenges of normative roles, balancing participation and speculation in order to better nurture community-driven technology visions. We propose future HCI work to further explore how to envision complex sustainability futures in a participatory way especially within work aimed at designing for grassroots community contexts. Also, for SHCI research to consider framing these endeavours in dialogue with community-based ‘experiments in living’ that recognise the distributed and embodied practices of tinkering essential for growing. We see the future role of the SHCI researcher here, as an essential partner with communities, acting as a facilitator, to help navigate the multi-scalar complexities of sustainability, while imagining alternatives that move with the community toward preferable futures. While engaging in both speculative and participatory design work can present challenges, it is important to recognise its potential value may exist beyond directed interventions such as workshops. Future work should seek to understand the effectiveness of such engagements and their potential outcomes in moving communities toward agendas of local food resilience and sovereignty.

## REFERENCES

- [1] Aloha Hufana Ambe, Margot Brereton, Alessandro Soro, Laurie Buys, and Paul Roe. 2019. The adventures of older authors: Exploring futures through co-design fictions. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–16.
- [2] Kristina Andersen. 2013. Making magic machines. In *10th European Academy of Design Conference*.
- [3] Kristina Andersen and Ron Wakkary. 2019. The magic machine workshops: visioning personal design knowledge. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [4] James Auger. 2013. Speculative design: crafting the speculation. *Digital Creativity* 24, 1 (2013), 11–35.
- [5] Corelia Baibarac and Doina Petrescu. 2017. Co-design and urban resilience: visioning tools for commoning resilience practices. *CoDesign* (2017).
- [6] Liam Bannon, Jeffrey Bardzell, and Susanne Bødker. 2018. Introduction: Reimagining participatory design—Emerging voices. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 1 (2018), 1–8.
- [7] Shaowen Bardzell. 2018. Utopias of participation: Feminism, design, and the futures. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 1 (2018), 1–24.
- [8] Stewart Barr and Justin Pollard. 2017. Geographies of Transition: Narrating environmental activism in an age of climate change and ‘Peak Oil’. *Environment and Planning A: Economy and Space* 49, 1 (2017), 47–64.
- [9] Karl Baumann, Benjamin Stokes, François Bar, and Ben Caldwell. 2016. Designing in “constellations” sustaining participatory design for neighborhoods. In *Proceedings of the 14th Participatory Design Conference: Short Papers, Interactive Exhibitions, Workshops-Volume 2*. 5–8.
- [10] Karl Baumann, Benjamin Stokes, François Bar, and Ben Caldwell. 2017. Infrastructures of the Imagination: Community Design for Speculative Urban Technologies. In *Proceedings of the 8th International Conference on Communities and Technologies*. 266–269.
- [11] Genevieve Bell, Mark Blythe, and Phoebe Sengers. 2005. Making by making strange: Defamiliarization and the design of domestic technologies. *ACM Transactions on Computer-Human Interaction (TOCHI)* 12, 2 (2005), 149–173.
- [12] Roy Bendor. 2012. Analytic and deictic approaches to the design of sustainability decision-support tools. In *Proceedings of the 2012 iConference*. 215–222.
- [13] Heidi R Biggs and Audrey Desjardins. 2020. High Water Pants: Designing Embodied Environmental Speculation. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [14] Aksel Biørn-Hansen and Maria Håkansson. 2018. Building Momentum: Scaling up Change in Community Organizations. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [15] Erling Björgvinsson, Pelle Ehn, and Per-Anders Hillgren. 2012. Design things and design thinking: Contemporary participatory design challenges. *Design issues* 28, 3 (2012), 101–116.
- [16] Erling Björgvinsson, Pelle Ehn, and Per-Anders Hillgren. 2012. Agonistic participatory design: working with marginalised social movements. *CoDesign* 8, 2-3 (2012), 127–144.

- [17] Eli Blevis and Susan Coleman Morse. 2009. Sustainably ours food, dude. *interactions* 16, 2 (2009), 58–62.
- [18] Mark Blythe, Kristina Andersen, Rachel Clarke, and Peter Wright. 2016. Anti-solutionist strategies: Seriously silly design fiction. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. 4968–4978.
- [19] Mark Blythe, Jamie Steane, Jenny Roe, and Caroline Oliver. 2015. Solutionism, the game: design fictions for positive aging. In *Proceedings of the 33rd annual ACM conference on human factors in computing systems*. 3849–3858.
- [20] Augusto Boal. 2002. *Games for actors and non-actors*. Psychology Press.
- [21] Susanne Bødker and Morten Kyng. 2018. Participatory design that matters—Facing the big issues. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 1 (2018), 1–31.
- [22] Laurens Boer and Jared Donovan. 2012. Prototypes for participatory innovation. In *Proceedings of the designing interactive systems conference*. 388–397.
- [23] Robin Bourgeois, Esther Penunia, Sonali Bisht, and Don Boruk. 2017. Foresight for all: Co-elaborative scenario building and empowerment. *Technological Forecasting and Social Change* 124 (2017), 178–188.
- [24] Tone Bratteteig and Wagner Ina. 2012. Disentangling power and decision-making in participatory design. In *Proceedings of the 12th Participatory Design Conference: Research Papers-Volume 1*.
- [25] Pam Briggs, Mark Blythe, John Vines, Stephen Lindsay, Paul Dunphy, James Nicholson, David Green, Jim Kitson, Andrew Monk, and Patrick Olivier. 2012. Invisible design: exploring insights and ideas through ambiguous film scenarios. In *Proceedings of the Designing Interactive Systems Conference*. 534–543.
- [26] Hronn Brynjarsdottir, Maria Håkansson, James Pierce, Eric Baumer, Carl DiSalvo, and Phoebe Sengers. 2012. Sustainably unpersuaded: how persuasion narrows our vision of sustainability. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 947–956.
- [27] Edward Burnell. 2018. Design for survivability: a participatory design fiction approach to sustainability. In *Proceedings of the 2018 Workshop on Computing within Limits*. 1–4.
- [28] Stuart Candy. 2010. The futures of everyday life: Politics and the design of experiential scenarios. *University of* (2010).
- [29] Stuart Candy and Jake Dunagan. 2017. Designing an experiential scenario: The people who vanished. *Futures* 86 (2017), 136–153.
- [30] Andrea Capaccioli, Giacomo Poderi, Mela Bettega, and Vincenzo D'Andrea. 2016. Participatory infrastructuring of community energy. In *Proceedings of the 14th Participatory Design Conference: Short Papers, Interactive Exhibitions, Workshops-Volume 2*. 9–12.
- [31] Alan Chamberlain, Andy Crabtree, Tom Rodden, Matt Jones, and Yvonne Rogers. 2012. Research in the wild: understanding 'in the wild' approaches to design and development. In *Proceedings of the Designing Interactive Systems Conference*. 795–796.
- [32] Jaz Hee-jeong Choi and Mark Graham. 2014. Urban food futures: ICTs and opportunities.
- [33] Rachel Clarke, Sara Heitlinger, Marcus Foth, Carl DiSalvo, Ann Light, and Laura Forlano. 2018. More-than-human urban futures: Speculative participatory design to avoid ecological smart cities. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial-Volume 2*. 1–4.
- [34] Jon Corbett. 2009. Good practices in participatory mapping: a review prepared for the International Fund for Agricultural Development (IFAD). (2009).
- [35] Paul Coulton, Dan Burnett, and Adrian Ioan Gradinar. 2016. Games as speculative design: allowing players to consider alternate presents and plausible futures. (2016).
- [36] Paul Coulton, Joseph Galen Lindley, Miriam Sturdee, and Michael Stead. 2017. Design fiction as world building. (2017).
- [37] Christopher A Le Dantec and Carl DiSalvo. 2013. Infrastructuring and the formation of publics in participatory design. *Social Studies of Science* 43, 2 (2013), 241–264.
- [38] Luiza Prado de O. Martins and Pedro JS Vieira de Oliveira. 2016. Breaking the cycle of Macondo: design and decolonial futures. *XRDS: Crossroads, The ACM Magazine for Students* 22, 4 (2016), 28–32.
- [39] Audrey Desjardins, Cayla Key, Heidi R Biggs, and Kelsey Aschenbeck. 2019. Bespoke booklets: A method for situated co-speculation. In *Proceedings of the 2019 on Designing Interactive Systems Conference*. 697–709.
- [40] Tawanna Dillahunt, Jennifer Mankoff, Eric Paulos, and Susan Fussell. 2009. It's not all about "Green" energy use in low-income communities. In *Proceedings of the 11th international conference on Ubiquitous computing*. 255–264.
- [41] Carl DiSalvo. 2012. *Adversarial design*. MIT Press.
- [42] Carl DiSalvo, Andrew Clement, and Volkmar Pipek. 2012. Participatory design for, with, and by communities. (2012).
- [43] Carl DiSalvo, Tom Jenkins, and Thomas Lodato. 2016. Designing speculative civics. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. 4979–4990.
- [44] Carl DiSalvo, Illah Nourbakhsh, David Holstius, Ayça Akin, and Marti Louw. 2008. The Neighborhood Networks project: a case study of critical engagement and creative expression through participatory design. In *Proceedings of the tenth anniversary conference on participatory design 2008*. 41–50.
- [45] Marketa Dolejsova. 2018. Edible speculations in the parlour of food futures. In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–10.
- [46] Paul Dourish. 2010. HCI and environmental sustainability: the politics of design and the design of politics. In *Proceedings of the 8th ACM conference on designing interactive systems*. 1–10.
- [47] Andy Dow, Rob Comber, and John Vines. 2019. Communities to the left of me, bureaucrats to the right... here I am, stuck in the middle. *interactions* 26, 5 (2019), 26–33.
- [48] Anthony Dunne. 2008. *Hertzian tales: Electronic products, aesthetic experience, and critical design*. Ph.D. Dissertation. Royal College of Art.
- [49] Anthony Dunne and Fiona Raby. 2013. *Speculative everything: design, fiction, and social dreaming*. MIT press.
- [50] E Melanie DuPuis and David Goodman. 2005. Should we go "home" to eat?: toward a reflexive politics of localism. *Journal of rural studies* 21, 3 (2005), 359–371.
- [51] Pelle Ehn. 2014. Utopias lost and futures-in-the-making: marginal notes on innovation, design and democracy. In *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts-Volume 2*. 191–193.
- [52] Chris Elsdén, David Chatting, Abigail C Durrant, Andrew Garbett, Bettina Nissen, John Vines, and David S Kirk. 2017. On speculative enactments. In *Proceedings of the 2017 CHI conference on human factors in computing systems*. 5386–5399.
- [53] Laura Forlano and Anijo Mathew. 2014. From design fiction to design friction: Speculative and participatory design of values-embedded urban technology. *Journal of Urban Technology* 21, 4 (2014), 7–24.
- [54] Arthur W Frank. 2010. *Letting stories breathe: A socio-narratology*. University of Chicago Press.
- [55] Cally Gatehouse. 2020. A hauntology of participatory speculation. In *Proceedings of the 2020 Participatory Design Conference*.
- [56] Alix Gerber. 2018. Participatory speculation: futures of public safety. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial-Volume 2*. 1–4.
- [57] Katarina I. Gidlund. 2012. Designing for all and no one-practitioners understandings of citizen driven development of public e-services. In *Proceedings of the 12th Participatory Design Conference: Research Papers-Volume 1*. 11–19.
- [58] Daniel Gooch, Matthew Barker, Lorraine Hudson, Ryan Kelly, Gerd Kortuem, Janet Van Der Linden, Marian Petre, Rebecca Brown, Anna Klis-Davies, Hannah Forbes, et al. 2018. Amplifying quiet voices: Challenges and opportunities for participatory design at an urban scale. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 1 (2018), 1–34.
- [59] Elizabeth Grosz. 2001. *Architecture from the outside: Essays on virtual and real space*. MIT press.
- [60] Xinning Gui and Bonnie Nardi. 2015. Foster the "mores", counter the "limits". *First Monday* (2015).
- [61] Xinning Gui and Bonnie Nardi. 2015. Sustainability begins in the street: A story of Transition Town Totnes. In *EnviroInfo and ICT for Sustainability 2015*. Atlantis Press.
- [62] Kim Halskov and Nicolai Brodersen Hansen. 2015. The diversity of participatory design research practice at PDC 2002–2012. *International Journal of Human-Computer Studies* 74 (2015), 81–92.
- [63] Karin Hansson, Laura Forlano, Jaz Hee-jeong Choi, Carl DiSalvo, Teresa Cerratto Pargman, Shaowen Bardzell, Silvia Lindtner, and Somya Joshi. 2018. Provocation, conflict, and appropriation: the role of the designer in making publics. *Design Issues* 34, 4 (2018), 3–7.
- [64] Donna Jeanne Haraway. 2003. *The companion species manifesto: Dogs, people, and significant otherness*. Vol. 1. Prickly Paradigm Press Chicago.
- [65] Donna J Haraway. 2013. SF: Science fiction, speculative fabulation, string figures, so far. (2013).
- [66] Steve Harrison and Paul Dourish. 1996. Re-place-ing space: the roles of place and space in collaborative systems. In *Proceedings of the 1996 ACM conference on Computer supported cooperative work*. 67–76.
- [67] Brad Haylock. 2019. What is critical design? In *Undesign: Critical Practices at the Intersection of Art and Design*. Routledge, Oxford, Chapter 1, 9–23.
- [68] Marie Heidingsfelder, Kora Kimpel, Kathinka Best, and Martina Schraudner. 2015. Shaping future—Adapting design know-how to reorient innovation towards public preferences. *Technological forecasting and social change* 101 (2015), 291–298.
- [69] Marie Lena Heidingsfelder, Fabian Bitter, and Ronja Ullrich. 2019. Debate through design. Incorporating contrary views on new and emerging technologies. *The Design Journal* 22, sup1 (2019), 723–735.
- [70] Sara Heitlinger, Nick Bryan-Kinns, and Janis Jefferies. 2013. Sustainable HCI for grassroots urban food-growing communities. In *Proceedings of the 25th Australian Computer-Human Interaction Conference: Augmentation, Application, Innovation, Collaboration*. 255–264.

- [71] Sara Heitlinger, Rachel Clarke, Adrian K Clear, Simran Chopra, and Özge Dilaver. 2019. Co-Creating "Smart" Sustainable Food Futures with Urban Food Growers. In *Proceedings of the 9th International Conference on Communities & Technologies-Transforming Communities*. 114–120.
- [72] Charlotte Hess and Elinor Ostrom. 2007. Introduction: An overview of the knowledge commons. (2007).
- [73] Sohail Inayatullah. 1990. Deconstructing and reconstructing the future: Predictive, cultural and critical epistemologies. *Futures* 22, 2 (1990), 115–141.
- [74] Ole Sejer Iversen and Christian Dindler. 2014. Sustaining participatory design initiatives. *CoDesign* 10, 3-4 (2014), 153–170.
- [75] Helena Karasti. 2014. Infrastructuring in participatory design. In *Proceedings of the 13th Participatory Design Conference: Research Papers-Volume 1*. 141–150.
- [76] Bran Knowles, Oliver Bates, and Maria Håkansson. 2018. This changes sustainable hci. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–12.
- [77] Sandjar Kozubaev, Chris Elsdon, Noura Howell, Marie Louise Juul Søndergaard, Nick Merrill, Britta Schulte, and Richmond Y Wong. 2020. Expanding Modes of Reflection in Design Futuring. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. 1–15.
- [78] Kari Kuutti and Liam J Bannon. 2014. The turn to practice in HCI: towards a research agenda. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 3543–3552.
- [79] Bruno Latour. 2005. From realpolitik to dingpolitik. *Making things public: Atmospheres of democracy* 1444 (2005).
- [80] Giacomo Lepri and Andrew McPherson. 2019. Making up instruments: Design fiction for value discovery in communities of musical practice. In *Proceedings of the 2019 on Designing Interactive Systems Conference*. 113–126.
- [81] Ann Light and Yoko Akama. 2018. The nature of 'obligation' in doing design with communities: Participation, politics and care. *Tricky Design: The Ethics of Things* 131 (2018).
- [82] Kristina Lindström and Åsa Ståhl. 2020. Un/Making in the Aftermath of Design. In *Proceedings of the 16th Participatory Design Conference 2020-Participation (s) Otherwise-Volume 1*. 12–21.
- [83] Szu-Yu Liu, Shaowen Bardzell, and Jeffrey Bardzell. 2019. Symbiotic encounters: HCI and sustainable agriculture. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [84] Sus Lyckvi, Virpi Roto, Elizabeth Buie, and Yiyang Wu. 2018. The role of design fiction in participatory design processes. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction*. 976–979.
- [85] Peter Lyle, Jaz Hee-jeong Choi, and Marcus Foth. 2015. Growing food in the city: design ideations for urban residential gardeners. In *Proceedings of the 7th International Conference on Communities and Technologies*. 89–97.
- [86] Noortje Marres. 2007. The issues deserve more credit: Pragmatist contributions to the study of public involvement in controversy. *Social studies of science* 37, 5 (2007), 759–780.
- [87] Noortje Marres. 2012. The experiment in living. *Inventive methods: The happening of the social* (2012), 76–95.
- [88] Ramia Mazé. 2019. Politics of designing visions of the future. *Journal of Futures Studies* 23, 3 (2019), 23–38.
- [89] Timon McPhearson, David M Iwaniec, and Xuemei Bai. 2016. Positive visions for guiding urban transformations toward sustainable futures. *Current opinion in environmental sustainability* 22 (2016), 33–40.
- [90] Annemarie Mol. 2008. *The logic of care: Health and the problem of patient choice*. Routledge.
- [91] Chantal Mouffe. 1999. Deliberative democracy or agonistic pluralism? *Social research* (1999), 745–758.
- [92] Bonnie Nardi, Bill Tomlinson, Donald J Patterson, Jay Chen, Daniel Pargman, Barath Raghavan, and Birgit Penzenstadler. 2018. Computing within limits. *Commun. ACM* 61, 10 (2018), 86–93.
- [93] Juliet Norton, Birgit Penzenstadler, and Bill Tomlinson. 2019. Implications of grassroots sustainable agriculture community values on the design of information systems. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–22.
- [94] Juliet Norton, Ankita Raturi, Bonnie Nardi, Sebastian Prost, Samantha McDonald, Daniel Pargman, Oliver Bates, Maria Normark, Bill Tomlinson, Nico Herbig, et al. 2017. A grand challenge for HCI: food+ sustainability. *interactions* 24, 6 (2017), 50–55.
- [95] Daniel Pargman, Elina Eriksson, Mattias Höjer, Ulrika Gunnarsson Östling, and Luciane Aguiar Borges. 2017. The (un) sustainability of imagined future information societies. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*. 773–785.
- [96] Daniel Pargman and Barath Raghavan. 2014. Rethinking sustainability in computing: from buzzword to non-negotiable limits. In *Proceedings of the 8th Nordic Conference on Human-Computer Interaction: Fun, Fast, Foundational*. 638–647.
- [97] Sebastian Prost, Clara Crivellaro, Andy Haddon, and Rob Comber. 2018. Food democracy in the making: Designing with local food networks. In *Proceedings of the 2018 CHI conference on human factors in computing systems*. 1–14.
- [98] Sebastian Prost, Elke Mattheiss, and Manfred Tscheligi. 2015. From awareness to empowerment: Using design fiction to explore paths towards a sustainable energy future. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*. 1649–1658.
- [99] Barath Raghavan, Bonnie Nardi, Sarah T Lovell, Juliet Norton, Bill Tomlinson, and Donald J Patterson. 2016. Computational agroecology: Sustainable food ecosystem design. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. 423–435.
- [100] Ankita Raturi, Juliet Norton, Bill Tomlinson, Eli Blevis, and Lynn Dombrowski. 2017. Designing sustainable food systems. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems*. 609–616.
- [101] Christian Remy, Oliver Bates, Alan Dix, Vanessa Thomas, Mike Hazas, Adrian Friday, and Elaine M Huang. 2018. Evaluation beyond usability: Validating sustainable HCI research. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–14.
- [102] Marco C Rozendaal, Marie L Heidingsfelder, and Frank Kupper. 2016. Exploring embodied speculation in participatory design and innovation. In *Proceedings of the 14th Participatory Design Conference: Short Papers, Interactive Exhibitions, Workshops-Volume 2*. 100–102.
- [103] Juan Sanin. 2020. Designing with as People. In *Proceedings of the 16th Participatory Design Conference 2020-Participation (s) Otherwise-Volume 2*. 124–127.
- [104] Vandana Shiva. 1993. *Monocultures of the mind: Perspectives on biodiversity and biotechnology*. Palgrave Macmillan.
- [105] M Six Silberman, Lisa Nathan, Bran Knowles, Roy Bendor, Adrian Clear, Maria Håkansson, Tawanna Dillahunt, and Jennifer Mankoff. 2014. Next steps for sustainable HCI. *interactions* 21, 5 (2014), 66–69.
- [106] Robert Soden and Nate Kauffman. 2019. Infrastructuring the Imaginary: How Sea-Level Rise Comes to Matter in the San Francisco Bay Area. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–11.
- [107] Sheinando Stals, Michael Smyth, and Oli Mival. 2019. UrbanInxD: From Ethnography to Speculative Design Fictions for the Hybrid City. In *Proceedings of the Halfway to the Future Symposium 2019*. 1–10.
- [108] Susan Leigh Star and Karen Ruhleder. 1996. Steps toward an ecology of infrastructure: Design and access for large information spaces. *Information systems research* 7, 1 (1996), 111–134.
- [109] Marc Steen. 2013. Co-design as a process of joint inquiry and imagination. *Design Issues* 29, 2 (2013), 16–28.
- [110] Joshua Tanenbaum, Marcel Pufal, and Karen Tanenbaum. 2016. Furious futures and apocalyptic design fictions: popular narratives of sustainability. *interactions* 24, 1 (2016), 64–67.
- [111] Bruce M Tharp and Stephanie M Tharp. 2019. *Discursive design: critical, speculative, and alternative things*. MIT Press.
- [112] Mikey Tomkins. 2012. You are Hungry: Flâneuring, Edible Mapping and Feeding Imaginations. *FOOTPRINT* (2012), 15–36.
- [113] Jasper Tran O'Leary, Sara Zewde, Jennifer Mankoff, and Daniela K Rosner. 2019. Who gets to future? Race, representation, and design methods in Africatown. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–13.
- [114] Ron Wakkary, Audrey Desjardins, Sabrina Hauser, and Leah Maestri. 2013. A sustainable design fiction: Green practices. *ACM Transactions on Computer-Human Interaction (TOCHI)* 20, 4 (2013), 1–34.
- [115] Ron Wakkary, William Odom, Sabrina Hauser, Garnet Hertz, and Henry Lin. 2015. Material speculation: actual artifacts for critical inquiry. In *Proceedings of The Fifth Decennial Aarhus Conference on Critical Alternatives*. 97–108.
- [116] Ron Wakkary and Karen Tanenbaum. 2009. A sustainable identity: the creativity of an everyday designer. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. 365–374.
- [117] Jon Whittle. 2014. How much participation is enough? A comparison of six participatory design projects in terms of outcomes. In *Proceedings of the 13th Participatory Design Conference: Research Papers-Volume 1*. 121–130.
- [118] Kelly Widdicks and Daniel Pargman. 2019. Breaking the Cornucopian Paradigm: Towards Moderate Internet Use in Everyday Life. In *Proceedings of the Fifth Workshop on Computing within Limits*. 1–8.