# Infrastructuring ecological sustainability through multi-scalar speculations

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

Clara Crivellaro
Open Lab, Newcastle University
Newcastle upon Tyne, United Kingdom
clara.crivellaro@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

## ABSTRACT

This paper responds to the challenges faced by grassroots sustainability communities in addressing ecological issues, through local action. Now more than ever, designers must fully engage with the messy side of these collaborative practices as we strive to support and sustain socio-political actions to foster more sustainable ecological futures connected to wider landscapes of socio-political change. We report on a community food growing project, as an example of sustainability research within Participatory Design demonstrating the complexity of such engagements when working through relationships across local and global concerns. We focus on infrastructuring place-based actions of the community, connecting these to the broader socio-political and economic landscapes. We contribute a multi-scalar perspective to speculative participatory workshops to connect everyday ecological food practices and imagined futures to socio-political realities across micro, meso, and macro scales. The workshops surfaced how socio-material complexities shape imaginations for sustainability and relational civic agency for situated change.

## CCS CONCEPTS

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

## KEYWORDS

sustainability, infrastructuring, grassroots communities, food growing, participatory design


*PDC 2022 Vol. 1, August 19–September 01, 2022, Newcastle upon Tyne, United Kingdom*

ACM ISBN 978-1-4503-9388-1/22/08…$15.00
https://doi.org/10.1145/3536169.3537776

**ACM Reference Format:**
Simran Chopra, Rachel E Clarke, Clara Crivellaro, Adrian K Clear, Sara Heitlinger, and Ozge Dilaver. 2022. Infrastructuring ecological sustainability through multi-scalar speculations. In *Participatory Design Conference 2022: Volume 1 (PDC 2022 Vol. 1), August 19–September 01, 2022, Newcastle upon Tyne, United Kingdom.* ACM, New York, NY, USA, 13 pages. https://doi.org/10.1145/3536169.3537776

## 1 INTRODUCTION

Infrastructuring has played a key role in Participatory Design's (PD) efforts to support long-term community interventions that continue beyond designers' actions [45, 57, 63]. Recently, an increasing number of authors have urged the PD community to play a more significant role in addressing the longitudinal global issues that are plaguing the planet as a matter of priority [5, 13, 40, 50, 51]. Of particular concern is the need to foster understandings of ecological unsustainability as a consequence of complex social practices [17] entwined within multiple normative structures [12, 60] like local government policies; and how these structures dis-empower citizens by disregarding situated knowledge and place-based interventions [22, 28, 58, 66] which have complex histories, and fragile ecosystems [4, 15, 24].

Prior work in PD engaging with grassroots sustainability has focused on co-developing futures [15, 23, 25] or challenging normative ones by creating alternatives [6, 7, 26, 51]. However, while many of these reported projects tend to portray a fairly unproblematic narrative of success— the wider PD research community is becoming increasingly aware (also through reflecting on our own realities) that there are often two sides to the PD process; the reporting of our (successful) research stories and the (often) hidden and harder to articulate messy conflictual dimensions unfolding through the PD processes [2, 11, 62]. With the ever-so-present challenges that ensue from the climate crisis, now more than ever, we must fully engage with the messy side of these practices. We must do this to respond to the challenges (and limitations) that PD faces as it strives to support and sustain socio-political actions. To foster more sustainable ecological futures as they are so forcefully shaped by wider landscapes of socio-political change.

In this paper we report on a series of speculation-oriented engagements with an urban food growing community at the early stages of an infrastructuring process, as an example of sustainability research within PD [37–39]. In this work, we understand the efforts of our community of food growers, as a way of living a more sustainable life, by challenging existing ecologically unsustainable lifestyles, habits and habitats. Our exploratory series of four PD workshops was designed to scaffold and reveal the messy underlying values, politics and attachments driving ongoing efforts of a local urban food growing community. We aimed to foster relational spaces where everyday eco-sustainable food practices and their imagined futures; could be articulated and connected to wider structures and landscapes of socio-political and economic uncertainties faced by the community. In order to build capacity and better navigate such complex contexts.

More specifically, we employed a variety of multi-scalar design strategies and tactics to bring to the fore the tensions and conflicts that arise at different intersecting scales *(micro, garden and neighbourhood; meso, national policy; macro, planet)* as everyday activities are related to, and connect local, national or global politics. This research is part of a long-term collaboration involving academic researchers and a local Community Interest Company (CIC) based in an economically deprived neighbourhood in the UK. The four speculative workshops have been reported by Heitlinger et. al [39] presenting understandings of everyday practices of the community in relation to smart city visions. Also, by Chopra et. al [18] delving deeper into the methodological contributions and understandings of employing an iterative workshop design process. This paper focuses on exploring with the community, future socio-technical visions for food growing to shed light on how these are positioned within, and constrained by local, national and global socio-political contexts. Through this work, positioned at the early stages of our ongoing infrastructuring process, we contribute understandings of relational agency and infrastructuring for sustainable design using a multi-scalar perspective on sustainable practices. Within this approach, and manifested through the design of various speculative spaces, we address questions of how to meaningfully support communities in exposing concerns as they envision future ecological sustainability.

## 2 BACKGROUND WORK

Participatory Design (PD) has a long history of working with communities with the aim of supporting broader social actions that respond to issues of concern in different domains [25, 45]. PD has long recognised how communities are socially constructed and are considered much more open than more formally constituted groups. Thereby requiring different structures to facilitate participation responding to the open, dynamic and heterogeneous way in which they are socially and flexibly constituted. Many PD projects are motivated by an underlying commitment to political design as being embedded in the production of publics [32], aiming to make social and political issues and shared struggles visible. These commitments are understood as a first critical step to enable responses to complex social issues that necessarily demand collaborative responses [11, 46, 55]. In this regard, the concept (and practices) of infrastructuring has played a key role in the design and theorising of longitudinal engagements aiming to support community-based interventions for the last two decades [45, 57, 63].

In this area of work, designers and researchers have drawn attention to the need to address different stakeholder demands [25, 30, 49], and have developed diverse methods and tools [59] to advance understanding of the long term impact of PD work in socio-political settings [1]. Further to this, infrastructuring has been discussed in relation to managing global-local nexus when looking at technology [12, 63, 66]; addressing grassroots movements [23] and creating social innovation infrastructures [53, 58, 66]. It has also been considered within the context of sustaining engagements through iterative processes and looking at addressing issues at larger scales [43, 51, 59]. However, there has been limited work that looks to explore how PD infrastructuring efforts might support the needs of communities of interest, developing tools and processes that can help address the complexity of ecological sustainability. An issue that necessarily brings together local and global efforts and multiple stakeholders. Indeed, addressing ecological sustainability demands moving between different scales of actions and their consequences (local/global; micro/macro), and the engagement of diverse stakeholders with different expertise and concerns (e.g. local politicians, policymakers, citizens, consumers, etc.). It also demands the development of design strategies for the creation of 'frictions' in infrastructuring civic engagement in order to create alternatives [47].

Most importantly infrastructuring refers to a mode of doing, participatory design that helps to develop long-term community endeavours through emphasising a relational mode of practice [1, 2]. Crivellaro describes how infrastructuring *'as a design practice is used to designate the ongoing processes and activities required to develop and strengthen socio-material relations and better support people working together in different areas of social life'* [22]. Karasti has further highlighted the different ways infrastructuring practice occurs within PD and social innovation [46]. Which includes finding ways to surface what constitutes the *'installed base'* of existing communities of practice as to further support critical engagements with the range of constituent 'things' and factors that together shape future action. These *'things'* can form part of a meshwork that includes the material resources available and required, access to information, people, networks, skills and values that can be brought to bear for embedding and building support for future community action. Furthermore it also includes the designer as mutually constituted and entangled in these processes [1]. While surfacing issues within the installed based of socio-technical practices may suggest a straightforward task, it is well documented that these are also fraught with uneven power dynamics and political complexities in terms of what is rendered visible, invisible, or indeed relatable in and through these co-constitutive acts of design [1, 11].

In this work we consider what infrastructuring processes are relevant to the exploration of messy intertwined political layers affecting sustainability within urban food growing. Prior work with local food growing communities working towards addressing ecological sustainability focuses on addressing global issues such as climate change [37, 38] through place-based interventions responding to intra-community action or individual growers values [28, 39]. However, these examples of collaborative acts of growing do not outline the political multiscalar complexities that affect local action

through top down trickle effects such as government policies. These complexities arise from negotiations of multiple stakeholders, conflicted values and the need for longitudinal sustained engagement beyond the workshops [11]. Our multiscalar approach looks at sustainability as a design problem involving complex issues around environmental degradation intertwined with social problems that must be explored and addressed over suitable longer time scales. In the context of ecological sustainability, this specifically pulls focus on how infrastructuring can help surface the multiscalar political complexities of socio-material infrastructures that shape everyday practices and political action within the context of a local neighborhood community.

## 3 CONTEXT AND BACKGROUND OF THE PROJECT

The project engages with a neighbourhood in the North-East of England, which has a vibrant local community of civic food growing initiatives. Most residents in the neighbourhood live in renovated 19th-century terraced houses and flats. These have limited or no growing space such as small walled front entrances and concrete backyards which are connected to shared backlanes. These spaces have limited available sunlight making it difficult for residents to grow plants. The food growing community makes use of the community orchard, and fenced garden which is part of the large public park alongside the neighbourhood. The residents of the neighbourhood are multi-ethnic, originating from South Asia, the Middle East, Africa, and Eastern Europe alongside the native British. This diversity is reflected in the local food shops and small takeaway restaurants on the high street adjacent to many of the terraced houses.

People in the local food growing community are involved in many different initiatives. These include allotment growers, food growing micro-businesses, time exchange volunteers, 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 is predominantly volunteer-driven or part of a time banking scheme, where taking part in food growing activities was used as a means of exchange for grown vegetables or for other services available in the community.

The neighbourhood has residents that are increasingly concerned about food sovereignty alongside everyday concerns for litter. There are also families that experience food poverty and malnutrition and access local food banks. There are many organisations operating within the neighbourhood which try to bring about change in the living conditions of the residents. Green East (Pseudonym) is involved in many such initiatives including maintaining the public park, local food growing schemes including local micro-businesses, litter picking, community events, fundraising, and knowledge exchange. Green East uses a local magazine, Facebook page and website to engage and inform residents. Since 2018, the area has seen austerity measures and significant funding cuts which has affected many of these initiatives, either they are terminated or at the risk of it. This also coincided with the closure of a local allotment site next to the public park, which the local authority has now re-purposed for grazing cattle. Residents have been voicing concerns over these developments, and in particular regarding the loss of the growing site and the new use of the allotment land.

Within this challenging and changing political landscape, one of the local micro-businesses, *'VerticalVeg'*, has supported local residents' in their food growing endeavours. They delivered educational sessions and facilitated knowledge sharing on how to grow in limited concrete spaces to address the lack of council support, growing space, and limitations in knowledge about how to grow food. Our involvement with this neighbourhood began in December 2017 when Mark Ridsdill Smith — the director of 'VerticalVeg', contacted our research team to explore alternative ways to envision future community-based food growing opportunities and how technology might support local communities self-organise around their sustainable-living initiatives. In collaboration with *'VerticalVeg'*, we developed a series of workshops that would enable collective explorations of sustainable futures for urban food growing.

With funding no longer available through Green East, 'VerticalVeg' since 2019 decided to continue its events such as knowledge sharing and food growing meetups through the support of a core volunteer group which organised meetings on the streets or at members' houses. Members shared tips and tricks, seeds, excess produce, equipment, recipes, preserves and prepared food, during face to face community meetups. Some of the authors have continued to take part in these activities after the workshop series finished. During 2020 they also self-organised Zoom meetups and assembled micro-green growing kits with the help of the first author. The communication was largely done through social media, emails, word-of-mouth and flyers to inform people about events, share queries and informational videos about food growing. Since 2020 the members have continued to adopt platforms such as Zoom to stay connected and organise events. This was also in response to the ongoing challenges of access to infrastructure, limited financial resources, wider engagement in the area and time constraints. In the next section we detail how these existing concerns over community structures and uncertain futures for food growing activities shaped our approach to this collaborative research, and how we strived to open up multiscalar concerns about food-growing civic actions to explore the scope for community sustainability projects and visions.

## 4 INFRASTRUCTURING MULTISCALAR EXPERIMENTS

### 4.1 Methodological commitments

Our methodological approach was informed by work in participatory and speculative design that seeks to challenge normative assumptions on future living [6, 7, 17, 26, 51] alongside infrastructuring as a means of surfacing matters of concern and sensitising to the 'installed base' of the growing community [22, 46]. We recognised that as a community of practice around urban food growing they have evolved these practices over several years and were engaged in their own forms of everyday sustainable living experiments [54], sharing their learning online and in meet-ups. In-situ, experiments like soil optimization, seed hybridization and creative recycling are examples of processes carried out in natureculture [33] which come

**Table 1: multi-scalar workshops at early stages of infrastructuring process**

| Workshop | Engagement | Scale | No. Participants | When |
|---|---|---|---|---|
| Workshop 1 | Map Making | Micro/Individual/Neighbourhood | 12 | March 2018 |
| Workshop 2 | Speculative Walk | Meso/Neighbourhood/City | 8 | April 2018 |
| Workshop 3 | Game of Fictional Lands | Macro/National/Global | 8 | May 2018 |
| Workshop 4 | Worldbuilding for alternate worlds | Planet Earth/Other Planets | 3 | June 2018 |

with considerable knowledge and technical vocabulary [52]. Liu et. al. credit grassroots communities for inventing and testing such practices that blend technological, biological and agricultural expertise [52]. Our work builds on this localised expertise and knowledge sharing, while surfacing relevant actants and influences at different interconnected scales as a way to support the community in reflecting on the impact these elements could have on their future growing endeavours.

The context of sustained engagement, can be extended through an iterative approach for tackling large scale projects [59] which lays emphasis on what is sustained and by whom. This is interconnected and entangled with local and global concerns, stakeholders and environments [43, 51]. Local food growing as a well rehearsed site for sustainable action, sits within a nexus between planetary systems, global and local ecologies and political economies [40, 58]. Therefore to create an evolving [43] process that would surface such a nexus, we devised a series of experimental workshops where we actively sought to bring to the fore everyday future-oriented practices that connect different socio-political and economic scales linked to potential futures. With our workshops' design we aimed to open spaces where multiscalar concerns and practices around food growing and ecological sustainability could be explored and their relationships examined. Çağlar & Schiller (2021) describe a multiscalar orientation as the *'socio-spatial spheres of practice that are constituted in relationship to each other and within various hierarchies of networks of power'(pg. 210). Scales are therefore not considered as distinct in their spatial categorisation (micro, meso, macro) but are 'mutually constituted, relational, interpenetrating [...] spanning global interconnected processes'*[14].

Therefore applying a multi-scalar orientation to infrastructuring in design calls for explicitly attempting to surface the different scales enacted in everyday socio-material practices. Furthermore, to address these multiscalar concerns we moved away from the experiment as a site where controlled variables can validate hypotheses, to an approach which is iterative, evolving [43] and involves ongoing tinkering [56]. Where emergence of responses and concerns are key to each workshop [31, 42], aligning with research *'in the wild'* [16, 44] or *'living labs'* [8, 9]. Here the socio-technical or design interventions are staged to intervene in everyday life as a site for applying situated methods that surface alternative forms of awareness and relational understanding. To this end we designed each workshop in accordance with the responses and concerns surfaced in previous ones, and brought these into dialogue with specific geographical scales, see Table 1. Focusing on a food growing community and their practices to deepen multiscalar explorations rather than extending it beyond the community. Thus leading to the emergence of multiscalar themes and concerns e.g. power, relationships, place; expressed by the community and then folding these insights from each workshop into the next subsequent session.

## 4.2 Workshop Series

During the course of the workshops, researcher notes, and reflections were used in the design and development of each subsequent workshop as previously described by [41] and [20]. The following is an overview of each workshop and how we attempted to weave each session together and to work with particular scales.

*4.2.1 Workshop 1: Map Making.* The first workshop focused on personal gardens and individual interpretations of the existing neighbourhood through a mapping exercise. The map making activity was designed as an invitation [51] for the participants to share local knowledge, to challenge our and groups' assumptions and expectations, about the community and our engagement, respectively. By initially acknowledging that collaborative activities and thinking about the future can sometimes be uncomfortable and demanding, we created the map-making activity as a space for individual expression, later enabling the group to share and negotiate points of interest, perspectives, and values [39]. Inspired by prior participatory mapping methods [21], the activity focused on capturing understandings of place and belonging at a local neighbourhood scale and in relation to food growing. The activity asked participants to respond to prompt card questions and populate a partially sketched geographical cardboard map seen in Fig.1 which only had key landmarks to help with orientation. The map was purposely left sparse for participants to add places of significance for them and to later elicit different understandings of 'place' [34] with respect to food growing for them and in the neighbourhood. After completing the workshop the research team read responses from the prompt cards and recorded field-notes of discussions during the workshop to map geographical areas of interest and related concerns raised through the participatory mapping exercise. This was later used to inform potential sites for a community walk.

*4.2.2 Workshop 2: Speculative Walk.* The second workshop geographically focused on the embodied experiences of the local neighbourhood. The aim of this workshop was to build on the discussions about specific sites highlighted during the mapping activity in Workshop 1 by moving the scale from an individual narrative (e.g., personal gardens and individual perspectives on sites of interest), to collective and embodied sense making of, and speculation about, particular neighbourhood places. Taking inspiration from walking methods applied in the literature [65], while also incorporating fictional scenarios like Stals et. al [61], we identified 6 geographical areas of interest and used them as suggestions for a structured walk to situate discussions around selected places.


**Figure 1: The participants populating the cardboard map of their neighbourhood using prompt cards**


**Figure 2: The group walking in the neighbourhood during the speculative walking activity**

Areas included residential streets and roads, back lanes of houses, an abandoned hospital site, and local grocery stores.

The walk included fictional scenarios to suspend disbelief about what was possible, while retaining community values intact through the chosen sites as seen in Fig.2. This aimed to encourage critical reflection on the existing configurations of food growing spaces in the neighbourhood and scaffold discussions into creating future possibilities. Scenarios were based on themes emerging from Workshop 1, e.g. limited growing spaces and the use of public spaces, and these were corroborated through a desk survey of recent news articles and other successful and more speculative food growing projects by the research team. Images were collected from these projects as future visions for the neighbourhood for participants to think about and 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 coordinate this?"* or *"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?"*

Audio and video data from Workshop 2 was openly coded independently by the second and fifth authors after initial transcription. This analysis highlighted values, fears and hopes associated with growing in the neighbourhood with relation to the particularities of place and the different actors involved in constraining or creating opportunities for future food growing within the community which later provided inspiration for the game design in Workshop 3.

*4.2.3 Workshop 3: Game of fictional lands.* The third workshop focused on negotiating what the challenges and opportunities surfaced in Workshop 2 might mean for the futures at national and global scales. It was devised to further unravel the conflicts and tensions around norms and values presented in Workshop 2, and build on opportunities for agonistic deliberation by moving beyond the scale of the individual or neighbourhood. We began by analysing

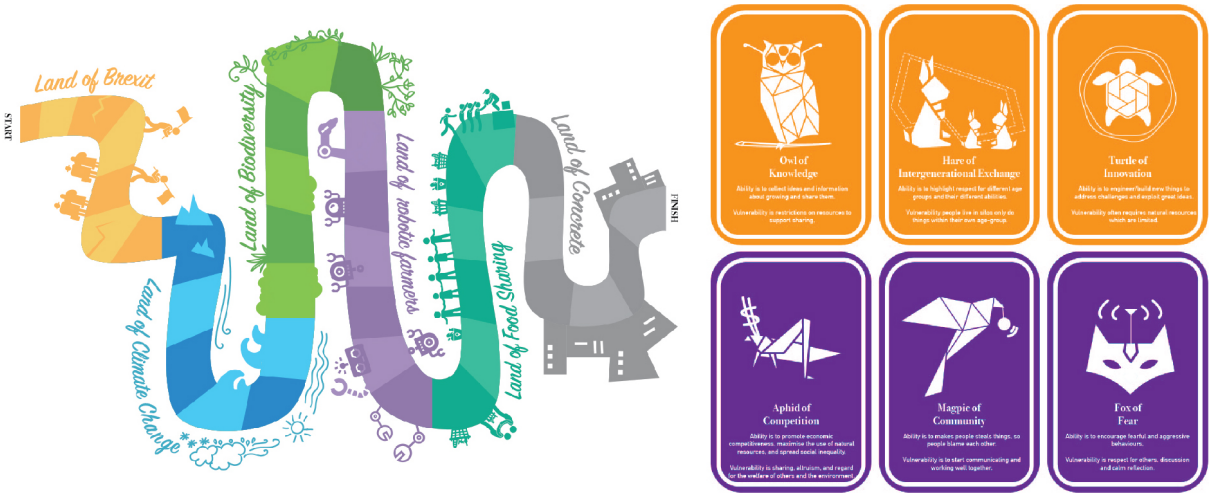


**Figure 3: Game design and developed beasts of opportunity and concern cards for Workshop 4**

the data from the previous workshop, drawing out concerns, fears, hopes and values of the community. Taking inspiration from recent work on developing and using games in design workshops [10] and the idea of games to introduce more playful conversations [22] we designed a board game to navigate between existing and fictional social and spatial realities. It was designed as a turn-based, race game arranged into future lands based on an analysis of the data collected from Workshop 2. Lands were characterised by ideas like the use of robots, Brexit, and climate change, relative to the lived realities of the neighbourhood described by residents. The board game and related cards are shown in Fig.3.

*The gameplay:* each player represents themselves on the board with a token like jars of herbs and spices, stones, and seeds etc. A player rolls a dice to move forward on the board. On arriving on a land, the player describes and discusses together with the group what growing food in this land would be like. To scaffold further critical thinking, the board is populated with beasts, which are either positive or negative influences on life in the land. Some squares on the board are coloured purple or orange to indicate a negative beast of concern or a positive beast of opportunity, respectively. A deck of cards was designed for both beast categories. When a player lands on a new coloured square they must pick a beast card from the corresponding deck and read the card to the group then discussing how the beast might affect food growing in the land. The beast cards reflect values or challenges expressed by participants in the last workshop, relating them with specific animals or insects which are associated with mythological and food growing folklore. Each card describes both the beast's abilities and weaknesses, representing dimensions to be considered with respect to its existence or mitigation in a given land. For example,

*Fox of Fear*

> Ability - encourage fearful and aggressive behaviours
> Vulnerability - respect for others, discussion and calm reflection

*Hare of Inter-generational 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 analysed in the same way as Workshop 2 with key themes used as inspiration for more regenerative and restorative future worlds and world building activities in Workshop 4.

*4.2.4 Workshop 4: Worldbuilding for alternative worlds.* The fourth and final workshop focused on the global and universal scale looking at the creation of a community of food growers on a new planet. We aimed to foster space for speculation that could move beyond feelings of helplessness and lack of agency expressed in prior workshops. After considering various forms that an activity to design a new planet might take, we decided to use material making, grounded in the narratives and values of growing that surfaced in previous workshops and represented the meanings, knowledge, and expertise in the community. We drew on our learning from deliberations in Workshop 3, situatedness in Workshop 2, and craft to support community materialisations of tacit knowledge and its connections to embodied growing practices in Workshop 1. We also drew inspiration from Andersen et. al's Magic Machines approach [3] and from Heideingsfelder et. al.'s idea of 'participatory design fictions' made by laypeople to give shape to societal needs and perspectives [35, 36].

The world-building task asked the community to be part of the genesis of a new food growing planet. The fictional scenario used for the world building task was designed as an invitation letter building on the positive experiences and skills of the community. The participant role was one of an expert knowledge bearer of food growing. As a member of the British Interplanetary Society, they were invited to visit the new planet and build infrastructures for food growing. We invited the participants to conceptualize and build a 3-dimensional world as seen in Fig.4. We provided them with a range of materials including cardboard boxes, plasticine, straw, small plastic figurines and animals, plastic bottles, cans, and other craft and natural materials like feathers, sticks, stones, mud


**Figure 4: Developed worlds during the world making activity**

and leaves. Participants were encouraged to tangibly represent their future visions and desirable community values for food growing from across the workshop series using these materials. These values, such as trust, festivities, intelligence, re-use, beauty, wisdom, sharing, diversity - were written on wooden sticks so that people could use them as signposts or motivators for framing and refining their worlds.

### 4.3 Recruitment, Data collection and analysis

We used posters to advertise, food growing hands-on skill-sharing sessions followed by creative workshops with free seeds and lunch. In this way we sought to attract a diverse group of residents in the neighbourhood who were already interested in food growing practices and would like to learn a new skill. All the 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 VerticalVeg. 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 have been assigned pseudonyms to preserve anonymity. Video data was annotated specifically where community members speculated about futures.

As previously mentioned the data collected from each of the workshops has been iteratively analysed at different stages of the project including researcher notes, video, photography and audio-recordings. Once workshops were complete, a narrative analysis was conducted by the first author and calibrated through discussions with the second author, which involved placing all data in a chronological sequence including photographs, transcripts, video annotations and notes [29]. Following a close reading of the data from each workshop, significant events where participants speculated about the future were highlighted and the themes were then written into a narrative account to recreate an interpretative rendition of important moments of speculation from each workshop we present in the next section.

## 5 WORKSHOP FINDINGS: SURFACING MULTISCALAR CONCERNS

In this section we describe the multiscalar concerns that surfaced during the engagement with the community. For creatively exploring futures of food growing across different scales, at the early stages of an infrastructuring process. Each section introduces the focus of each workshop, presenting a prominent narrative which surfaced and exposed multiscalar concerns.

### 5.1 Creating commons through individual sharing and catharsis

The initial drawing and crafting in the mapping exercise exposed key tacit knowledge and concerns which are taken for granted in collective growing practices. The activity initiated the group into responding to specific questions on prompt cards about growing practices by representing their own current and future gardens. These discussions about current places to grow food or not to grow food beyond the participants' own gardens surfaced tensions over the use of communal council planters and backlanes that were often filled with rubbish and often hazardous materials. Most participants felt they couldn't possibly grow food in these contested and unmaintained public spaces, but Rosie, one of the members of the time exchange who helps with the growing activities in the community garden, believed otherwise. She referred to the recent closure of the local allotment site as a reason for the need for communal spaces to grow food. She expressed her frustrations through crafting a raised bed on the cardboard map while discussing the history of

the local allotment site with other participants. While there were differing oral histories and accounts for the allotment site ranging from the talk about an old bottle factory to a dumping site, the process of making and mapping the raised bed symbolised the lack of control and concern over the taking away of the growing land from the community. She asserted how for her, the crafted raised bed represented several geographical sites in the area and the wider community's aspirations for growing. She did so by inviting everyone to plant something in the crafted 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"*. Everyone present at the workshop responded to Rosie's invitation, by planting or crafting something to be put into the raised bed, seen in Fig.5.

The co-crafting of the map brought up the underlying lack of agency experienced by the community in terms of communal land or public spaces available for growing as they are controlled by the local government. A sense of catharsis for the loss of the community allotment site also surfaced, as multiple participants planted (different bits) in the crafted raised bed, as seen in Fig.5. The process gave the participants a safe and open space to present themselves as expert knowledge bearers. It invited them draw on their food growing knowledge and experience to create a collective picture of food growing in the neighbourhood that filled gaps in their own individual understandings and perspectives. It also invited us as researchers, and other less connected and novice growers in the neighbourhood, into the community through the sharing and commoning. In doing so, the mapping exercise created a materialisation of information, knowledge, cultural and creative commons [64]. As a result, it accommodated varying points of view, expressions, histories and opinions, and challenged individual assumptions about the neighbourhood. It thereby served to highlight particular areas of complexity for communal food growing not anticipated before, like the peculiarities of everyday practices and ideas of place, sense of agency with respect to food growing and place, and how these changed over time in the neighbourhood. These were further unpacked in subsequent workshops.

## 5.2 Situating tensions and future action within the neighbourhood

Workshop 2 served to really expose two tensions within the community and the neighbourhood. These were the need for intergenerational connection for social action, and the surfacing of the tacit norms and tensions of negotiating private/public spaces for food growing.

During the walk we discussed the participants' relationship with the neighbourhood by observing what was already growing there in concrete spaces, pots and small front gardens. Mark suggested roadside council planters to be used as community herb gardens. However, this reuse of the planters raised issues such as austerity, limited resources and manpower. In particular, it raised the question of who would be responsible for managing them, thus surfacing wider conflicts and tensions in the neighbourhood, and bringing out opposing values about shared food. For example, open and accessible front yards were a positive for Mark to invite interactions and conversations; however, it was a concern for other participants as they feared stealing and littering by other residents in the area which was already quite prevalent. When the conversation moved to other public spaces like the use of the city centre, car parks, hospitals, churchyards and schools to grow food for sharing in response to the fictional scenarios that we introduced, it resulted in discussions of access, money and control by the local authorities. This reflected the feelings of lack of agency over growing land that we saw in Workshop 1, which was linked to prior attempts made by the community to engage the council and other local stakeholders in their food growing endeavours. One example of this is the unsuccessful attempt to acquire community funding to continue a project that aimed to engage school children in growing food.

Similarly, contested private/public spaces like the communal back lanes were linked to ongoing issues of littering and negative experiences with other residents or the council. However, the fictional scenario *"The neighbourhood has won an award from Grow Your Own magazine for best innovative green food growing community"* gave Mark the opportunity to push the boundaries of the discussion and introduce the idea of using existing resources and technologies like, polytunnels and solar panels, refactors, and growing lights to create alternate imaginings for food growing in the backlanes.

> Mark: [You could funnel] the extra heating from the houses into the thing [polytunnel] 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[back lane].
> Samantha: It would need a lot of committed children!

The discussions centring around multi-generational values for engaging young people in food growing activities and the need to involve other stakeholders in existing practices for social action surfaced further aspects of limited agency. The speculative walk and its fictional scenarios also allowed for situated discussions that surfaced often tacit or taken for granted social norms, conflicts and tensions within the everyday realities that underlie or constrain the possibilities for on-the-ground action. Participants often found it difficult to imagine creatively and collectively beyond what was already present—imagined alternatives often evoked fear and disgust (rather than excitement and joy), which is the case when the future looks bleak due to an uncertain present. However, through the use of our fictional scenarios and with the help of the community expert Mark, we were able to engage the group in a redefinition of the everyday. This was not a leap into far-fetched futures, but a deeper engagement with the problems of today and how they could be dealt with differently. In this way, rather than providing an entry point or context for speculation, the situated and the everyday prompted the critical questioning of possibilities with the associated limitations of successfully growing food in the neighbourhood.

## 5.3 Experiences of dis-empowerment through scale

Workshop 3 highlighted the feelings of powerlessness felt by the community due to the ever looming ecological global issues like climate change and Brexit. We played the game outside the community

**Figure 5: Rosie's raised bed at the allotment site on the map**

garden with the participant group sitting around a table. During the play as the participants reached new lands in the game, they discussed how it would be to grow food in this land. We recorded the main discussion points on post-it notes placing them on the board itself around the land discussed. The game started on high emotions and strong opinions as the first land on the board was the Land of Brexit. This strongly related to the current political reality of the group in 2018 and led the participants into intense political debate around the government policies and ways of governing, also what it would be like to live and grow food after Brexit. Given that all participants indicated that they perceived Brexit and subsequently climate change as negative and damaging, speculations about futures beyond them were similarly framed and indicated the helplessness felt by the community and its members regarding issues of such global concern.

On reaching the Land of Robots, robotic farmers provided some comfort to the participants, as the ideas associated with efficiency were perceived positively. The food growing robot was compared to the functionality of a dishwasher, while their potential limits and the ongoing role of people in their success was also recognised: *"the machine is only as good as the programmer"* (Donald). Technology wasn't perceived as political in the way that Brexit was, and so the robotic futures provided the opportunity to reinscribe existing food growing values to technology. For example, the use of robots to help grow food without chemicals, enhance yield, help farmers with more leisure time and manage soil. Some participants feared that the availability of inexpensive robots would also end up deskilling people. However, the introduction of the opportunity card, 'Hare of Intergenerational Exchange', in the discussion brought in positive reflection on the passing on of food growing skills to future generations through the robots. As Robert explained *"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 to preserve the skill"*. This discussion was a glance into the potential change of the stakeholders and scenarios for the future, suggesting values to be embedded in the design of future technologies.

Playing the game was an intense and emotional experience, both for the participants and the researchers. As the fictional futures and speculative spaces were shaped by actual political landscapes (i.e. Brexit, etc.). This exposed the scale and uncertainty associated with macro-level challenges and with abstract concepts such as sustainability, climate change, and national and global politics. These evoked anxieties in participants, who voiced lack of agency in shaping and navigating events like Brexit and climate change, which

would eventually impact the community food growing futures at a local neighbourhood level. As a result, participants exchanged their current views and opinions on the matters of these macro-level concerns rather than engaging with the possibilities of creating alternative futures. It became difficult for us to encourage discussion on potential speculative responses to such significant world-reshaping events (Climate change, Brexit, etc). However, we also came to better appreciate the impact that these have on participants and their sense of the possible.

### 5.4 Problematising innovation through everyday practices and community values

Workshop 4 brought to the fore the ambivalent nature of technology and how re-appropriation of existing technology and innovation is necessary for infrastructuring future social action.

Technology played an important part within the design of the new worlds, even if embedded in everyday food growing practices it presented the capacity for awe like Mark's intergalactic device for sharing seeds and food growing knowledge with others from different planets which had close resemblance to the capabilities of the internet. Clair, a novice grower, wanted a *"dandelion zapper"* designed to automatically pull out dandelions from her land. Dandelions have deep roots she explained and were very difficult to get rid of, especially for people like her who are new to growing. Yet in her conversation with us the dandelion zapper she wanted quickly turned obsolete as she remembered and suggested innovative uses of the weed herself: *"well it would be very spot active [dandelion zapper] 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. [...] Dandelion risotto. It's medicinal."*

Similarly when considering governance in the new planets, these were built into the value-systems of the participants and the kind of compromises that they were willing to make, for example creating spaces for food growing which would mean the loss of existing biodiversity and ecology. Clair described her eco-community on the new planet as low tech; however, she was concerned about removing old trees for building and creating food growing spaces similar to colonisation. Yet, she decided as a governance measure not to have land ownership or transport: *"you know, we're colonising this world [new planet] and obviously if it's the same as here then it would have been forests wouldn't it? [...] you don't inherit anything and you live in it while you live in it [...] do away with the concept of land ownership altogether"*. This negotiation was similar to Rosie's suggestion of taking plastic from our current devastated planet to the new one as a form of exchangeable currency.

These negotiations and reconsiderations of values highlight the unbalance on our planet due to neo-liberal colonisation and capitalistic ownership, or how we should not excuse the chopping of trees without any balance in the new world. Such instances of reuse and repurposing draws our attention towards a reconsideration of present day problems where values of technology and innovation are sometimes problematised. However, the values and focus of the community was to look for ways in which current problems can be redefined to create possibilities for infrastructuring for alternate better futures and towards re-appropriated technology use. As participants crafted their worlds, they imbued them with socio-material values from the neighbourhood and personal growing practices opening up possibilities for more utopian visions of food growing worlds characterised by community values.

## 6 DISCUSSION

Sustainability and community-based research in recent PD and HCI has highlighted the importance of scale — not just in terms of focusing on local scale interventions, but also in terms of how future work should connect to larger scale social, political and economic factors that impact people's ability to make change [12, 19, 39, 43, 58, 59]. Without approaches that respond to these larger scale issues that impact social and ecological sustainability, interventions risk having limited meaningful impact, especially for communities seeking to make change on the ground. This points to the importance of infrastructuring, not only at the intimate and local scale, but also in terms of opening spaces that can bring into dialogue how communities relate to these wider complexities, and the range of actors and practices involved. Through our case study, we aimed to build capacity and resilience by activating different scales to support connections to the *'bigger picture'* of a detrimental economic and political system. Because this was at the early stages of infrastructuring, we intentionally focused on the community and its practices rather than extending it to other actors or communities in order to surface these multiscalar dimensions that underpin this specific community's sustainability efforts. The aim was to collectively have a better understanding of the implicit relationships and political structures that underpin food growing efforts, highlighting what was considered both valuable and problematic in current and imagined futures. In this section, we discuss our strategies for activating place-based concerns and surfacing relational civic agency when developing multi-scalar speculations in PD that can meaningfully support communities exposing concerns as they envision future ecological sustainability.

### 6.1 Infrastructuring place-based sustainability through multiscalar experiments

Infrastructuring efforts in PD have previously sought to surface the installed base that underpins community values, with the intention of using this understanding to make visible a network of relationships to mobilise collective future action [22, 46]. In the context of sustainability and more specifically urban food growing, place-based responses are significant for infrastructuring efforts. Since access to and use of specific pieces of land and soil is fundamental to the practice, in a way that isn't always relevant in PD contexts where infrastructuring and social innovation has previously taken place. At the same time the ability to grow food in urban areas is also impacted by a range of local and global concerns and influences beyond the control of residents. Our intention was to bring into dialogue these different scales, a multiscalar approach in a very practicable way by moving between very intimate spaces of home gardens to planetary care. While Çağlar & Schiller (2021) argue a multiscalar orientation does not consider scales as distinct from each other [14], to support discussion and surfacing of the interconnected relationships that span global processes, key geographical frames were used across the workshop series to draw

together both the situated necessity of community responses and the global inter-connectivity of their challenges.

Situating our workshops in the context of the neighbourhood, and the community's ongoing efforts in sustainable food growing activities, in juxtaposition to multiscalar issues, helped focus ideas and speculations around existing infrastructures and achievable place-based change [22, 58]. Thus, helping the community question their current ways of living more sustainably, within the the context of a perceived-to-be-broken socio-economic system that shapes them. This surfaced the gritty articulations of the valued and problematic relationships between community members, available resources, and constraining forces. The value of doing so was also found in the workshops' ability to bring to the fore how these issues were perceived differently by different members of the community, sparking debates and emotionally charged contestations; thus exposing place-based issues that embodied multi-scalar conflicts, like land ownership and conflicts of private-public spaces.

Through the multiscalar infrastructuring process we surfaced these tacit, taken for granted norms and politics embedded in mundane community infrastructures and their installed base [11, 45] — raising perhaps more profound questions as to what and who can benefit from community food growing. However, questions like these can lead to a diversity of responses, which can be difficult to consolidate into a consensual action for researchers or communities to tackle. Thereby, researchers need to create ways of navigating diversity of ideas and possible sustainable futures at the local scale in order to be able to act.

## 6.2 Surfacing relational civic agency

The multiscalar approach helped surface people's agency and how different actors, and their practices at local, national and global scale shape possibilities for action at the local scale. As seen across the workshops, participants' sense of their own ability to effect, and imagine change (e.g. their civic agency) varied according to the different actors, and structures (and their relations) which were invoked through different multi-scalar scenarios. For example, taking away of the allotment sites and neglect of the public spaces such as council planters is directly affected by austerity policies of the national governments. Hence, we see the emergence of scalar politics [27, 48] where the policy is created in a top down manner, and its effects trickle down to the local council and communities,thereby, affecting the community and their practices of everyday sustainability.

Overall, the multi-scalar approach enabled us to make visible variations in feelings of civic agency as they play out when relating community based localised action corresponding to tackling challenges arising from national and global scale politics. There is a danger however, that if these initial workshops are not followed up with more sustained actions [43, 59] (as per infrastructuring) people may be left feeling more disempowered than before. Therefore particular attention should be placed on fostering agency, explorations of relational practices and existing attachments (or indeed estrangements) towards people, material things and addressing complex norms of social and material realities such as policy, economics, and community participation. In particular, advancing future research which connects localised community setting to different hierarchical political and practical domains and developing ways to tie into existing networks and systems. Thereby, exploring how participatory infrastructuring can engage across scales, and agency and initiatives might be dispersed within these networks [11, 22]. Thus shifting our attention towards relational agency and how delicate it is to craft spaces trodding a fine line between reinforcing a feeling of disempowerment and opening spaces to recover un-constructive relations.

# 7 CONCLUSION

In this paper we considered the challenges faced by grassroots sustainability communities engaged in addressing ecological issues, as we worked towards the early stages of infrastructuring at the neighbourhood level, surfacing the messy side of community practices as they strive to support and sustain socio-political actions to foster more sustainable ecological futures. Our workshop approach was an attempt to connect these everyday ecological food practices and imagine futures to socio-political realities across micro, meso and macro scales. By developing a multiscalar approach we were able to understand how place based socio-material complexities can help shape change and relational civic agency to the community's cause.

This series of workshops took place at the initial stages of an ongoing (at the time of writing) infrastructuring process. 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 impact of our work and that of the community.

We recently began to investigate the benefits of technology use for community led actionable visioning with the same community. Our findings here have informed our approach to community speculation in that work, positioning these around place-based interventions in the neighbourhood. We are building on the futures discussed by the community in these workshops to scaffold further speculation about the future. Embracing people's agency as enablers and the possibility to shape action at a local level is important in this. We see value in using technology to allow discussions to take place over the longer-term in asynchronous ways. Our use of technology is also motivated by our endeavor to encourage participation from a broader neighbourhood demographic (e.g. the youth). These activities are engaging more residents in the neighbourhood with the content developed in the the workshops presented in this paper. This is also opening up concerns about different place-based issues, capacity for change, and is leading to the creation of a timeline (plan) of possible land-based projects for the neighbourhood's future.

# ACKNOWLEDGMENTS

We are sincerely grateful to our participants for their time and for sharing their perspectives and ideas with us. We are thankful to Nigel Todd and Mark Ridsdill Smith for their invaluable support in organising and running the workshops.

# REFERENCES

[1] Shana Agid. 2016. "... it's your project, but it's not necessarily your work..." infrastructuring, situatedness, and designing relational practice. In *Proceedings*

*of the 14th Participatory Design Conference: Full papers-Volume 1*. 81–90.

[2] Yoko Akama and Ann Light. 2018. Practices of readiness: punctuation, poise and the contingencies of participatory design. In *Proceedings of the 15th Participatory Design Conference: Full Papers-Volume 1*. 1–12.

[3] Kristina Andersen. 2013. Making magic machines. In *10th European Academy of Design Conference*.

[4] Corelia Baibarac and Doina Petrescu. 2017. Co-design and urban resilience: visioning tools for commoning resilience practices. *CoDesign* (2017).

[5] Shaowen Bardzell. 2018. Utopias of participation: Feminism, design, and the futures. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 1 (2018), 1–24.

[6] 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.

[7] 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.

[8] 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.

[9] Erling Björgvinsson, Pelle Ehn, and Per-Anders Hillgren. 2012. Agonistic participatory design: working with marginalised social movements. *CoDesign* 8, 2-3 (2012), 127–144.

[10] 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.

[11] Susanne Bødker, Christian Dindler, and Ole Sejer Iversen. 2017. Tying knots: Participatory infrastructuring at work. *Computer Supported Cooperative Work (CSCW)* 26, 1-2 (2017), 245–273.

[12] 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.

[13] Karin Buhmann. 2014. Enhancing collaborative rule-making on global sustainability concerns through participatory design: a research agenda based empirically on United Nations developments on business conduct. In *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts-Volume 2*. 63–66.

[14] Ayşe Çağlar and Nina Glick Schiller. 2021. Relational multiscalar analysis: a comparative approach to migrants within city-making processes. *Geographical Review* 111, 2 (2021), 206–232.

[15] 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.

[16] 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.

[17] Simran Chopra. 2019. HCI for Participatory Futuring in Sustainable Communities: Reconciling Visions with Everyday Practice. In *Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems*. 1–6.

[18] 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*. 1–17.

[19] Rachel Clarke, Sara Heitlinger, Marcus Foth, Carl DiSalvo, Ann Light, and Laura Forlano. 2018. More-than-human urban futures: Speculative participatory design to avoid ecocidal smart cities. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial-Volume 2*. 1–4.

[20] Rachel Elizabeth Clarke, Jo Briggs, Andrea Armstrong, Alistair MacDonald, John Vines, Emma Flynn, and Karen Salt. 2021. Socio-materiality of trust: co-design with a resource limited community organisation. *CoDesign* 17, 3 (2021), 258–277.

[21] Jon Corbett. 2009. Good practices in participatory mapping: a review prepared for the International Fund for Agricultural Development (IFAD). (2009).

[22] Clara Crivellaro, Rob Anderson, Daniel Lambton-Howard, Tom Nappey, Patrick Olivier, Vasilis Vlachokyriakos, Alexander Wilson, and Pete Wright. 2019. Infrastructuring public service transformation: Creating collaborative spaces between communities and institutions through HCI research. *ACM Transactions on Computer-Human Interaction (TOCHI)* 26, 3 (2019), 1–29.

[23] 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.

[24] 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.

[25] Carl DiSalvo, Andrew Clement, and Volkmar Pipek. 2012. Participatory design for, with, and by communities. (2012).

[26] 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.

[27] 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.

[28] 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.

[29] Arthur W Frank. 2010. *Letting stories breathe: A socio-narratology*. University of Chicago Press.

[30] Joan Greenbaum and Morten Kyng. 2020. Introduction: situated design. In *Design at work*. CRC Press, 1–24.

[31] Wendy Gunn, Ton Otto, and Rachel Charlotte Smith. 2013. *Design anthropology: theory and practice*. Taylor & Francis.

[32] 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.

[33] Donna Jeanne Haraway. 2003. *The companion species manifesto: Dogs, people, and significant otherness*. Vol. 1. Prickly Paradigm Press Chicago.

[34] 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.

[35] 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.

[36] 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.

[37] Sara Heitlinger, Nick Bryan-Kinns, and Rob Comber. 2018. Connected seeds and sensors: co-designing internet of things for sustainable smart cities with urban food-growing communities. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial-Volume 2*. 1–5.

[38] 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.

[39] 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.

[40] Sara Heitlinger, Marcus Foth, Rachel Clarke, Carl DiSalvo, Ann Light, and Laura Forlano. 2018. Avoiding ecocidal smart cities: Participatory design for more-than-human futures. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial-Volume 2*. 1–3.

[41] Jonathan Hook, Rachel Clarke, John McCarthy, Kate Anderson, Jane Dudman, and Peter Wright. 2015. Making the Invisible Visible: Design to Support the Documentation of Participatory Arts Experiences. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. 2583–2592.

[42] Tim Ingold. 2008. Anthropology is not ethnography. In *PROCEEDINGS of the British Academy*, Vol. 154. 69–92.

[43] Ole Sejer Iversen and Christian Dindler. 2014. Sustaining participatory design initiatives. *CoDesign* 10, 3-4 (2014), 153–170.

[44] Gereon Koch Kapuire, Heike Winschiers-Theophilus, Colin Stanley, Shilumbe Chivuno-Kuria, Kasper Rodil, McAlbert Katjivirue, and Ernest Tjitendero. 2014. Community-based co-design in Okomakuara a contribution to'design in the wild'. In *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts-Volume 2*. 207–208.

[45] Helena Karasti. 2014. Infrastructuring in participatory design. In *Proceedings of the 13th Participatory Design Conference: Research Papers-Volume 1*. 141–150.

[46] Helena Karasti, Karen S Baker, and Florence Millerand. 2010. Infrastructure time: Long-term matters in collaborative development. *Computer Supported Cooperative Work (CSCW)* 19, 3-4 (2010), 377–415.

[47] Matthias Korn and Amy Voida. 2015. Creating friction: Infrastructuring civic engagement in everyday life. In *Proceedings of The Fifth Decennial Aarhus Conference on Critical Alternatives*. 145–156.

[48] Airi Lampinen, Chiara Rossitto, and Christofer Gradin Franzén. 2019. Scaling Out, Scaling Down: Reconsidering growth in grassroots initiatives. In *Ethnographies of Collaborative Economies Conference, Edinburgh, Scotland, UK, 25 October, 2019.*

[49] 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).

[50] Ann Light, Alison Powell, and Irina Shklovski. 2017. Design for existential crisis in the anthropocene age. In *Proceedings of the 8th International Conference on Communities and Technologies*. 270–279.
[51] 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.
[52] 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.
[53] Ezio Manzini. 2014. Making things happen: Social innovation and design. *Design issues* 30, 1 (2014), 57–66.
[54] Noortje Marres. 2012. The experiment in living. *Inventive methods: The happening of the social* (2012), 76–95.
[55] Ramia Mazé. 2019. Politics of designing visions of the future. *Journal of Futures Studies* 23, 3 (2019), 23–38.
[56] Annemarie Mol. 2008. *The logic of care: Health and the problem of patient choice*. Routledge.
[57] Giacomo Poderi and Yvonne Dittrich. 2018. Participatory design and sustainability: a literature review of PDC proceedings. In *Proceedings of the 15th Participatory Design Conference: Short Papers, Situated Actions, Workshops and Tutorial-Volume 2*. 1–5.
[58] Sebastian Prost, Vasilis Vlachokyriakos, Jane Midgley, Graeme Heron, Kahina Meziant, and Clara Crivellaro. 2019. Infrastructuring Food Democracy: The Formation of a Local Food Hub in the Context of Socio-Economic Deprivation. *Proceedings of the ACM on Human-Computer Interaction* 3, CSCW (2019), 1–27.
[59] Jesper Simonsen and Morten Hertzum. 2012. Sustained participatory design: Extending the iterative approach. *Design issues* 28, 3 (2012), 10–21.
[60] Marie Louise Juul Søndergaard, Gopinaath Kannabiran, Simran Chopra, Nadia Campo Woytuk, Dilrukshi Gamage, Ebtisam Alabdulqader, Heather McKinnon, Heike Winschiers-Theophilus, and Shaowen Bardzell. 2022. Feminist Voices about Ecological Issues in HCI. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts*. 1–7.
[61] Shenando Stals, Michael Smyth, and Oli Mival. 2019. UrbanIxD: From Ethnography to Speculative Design Fictions for the Hybrid City. In *Proceedings of the Halfway to the Future Symposium 2019*. 1–10.
[62] Susan Leigh Star. 2002. Infrastructure and ethnographic practice: Working on the fringes. *Scandinavian Journal of Information Systems* 14, 2 (2002), 6.
[63] 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.
[64] Maurizio Teli, Angela Di Fiore, and Vincenzo D'Andrea. 2016. Computing and the common: an empirical case of participatory design today. In *Proceedings of the 14th Participatory Design Conference: Full papers-Volume 1*. 1–10.
[65] Mikey Tomkins. 2012. You are Hungry: Flâneuring, Edible Mapping and Feeding Imaginations. *FOOTPRINT* (2012), 15–36.
[66] Vasillis Vlachokyriakos, Clara Crivellaro, Pete Wright, and Patrick Olivier. 2018. Infrastructuring the solidarity economy: Unpacking strategies and tactics in designing social innovation. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. 1–12.