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Engaging the public in technological futures: A participatory speculative design approach to polyphonic representational spaces

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Abstract: Physical spaces have multiple dimensions, including tangible and intangible elements, eventually creating plural identities to which polyphonic speculation can contribute. The implementation of digital technology has reshaped spatial experiences and everyday practices. In this area of digital transition, policymakers have faced challenges juggling these technologies in public spaces, the needs of dwellers and their potential impact. The emerging field of speculative design offers a way of creating multiple scenarios for the future and provoking conversations regarding technological futures. Participatory speculative design (PSD) proposed here is a new approach to engage with people, not necessarily designers or technology experts, in the speculative design process. This paper presents a study employing the lenses of PSD to examine how this approach can bring polyphonic speculations from residents into a place and build narratives around digital technology in public spaces. It then discusses the potential of PSD in policymaking.

Keywords: Participatory speculative design; place-based approach; polyphonic speculation; policymaking

1. Introduction

In the last decades, we have been facing socio-technological transitions caused by the emergence of digital technologies. Digital technologies such as sensors, the Internet of Things, autonomous vehicles, drones, and artificial intelligence have reshaped spatial experiences and the practices of everyday lives and physical places. The concept of connected places (or Smart Cities) promises better quality of living for people in a public space based on data-driven decision-making (NCSC, 2021). A wide range of data can be collected, such as traffic

flows, noise levels, weather conditions, and human activities in public spaces (Hviid Trier & Jenkins, 2020). However, the integration between digital and physical has generated new 'wicked problems' affecting multiple stakeholders and sectors (Carr & Lesniewska, 2020). Initiatives presented by central governments in response to digital technology implementation are often criticised as a top-down approach that needs to be more reflective of the needs of locals (Dourish & Bell, 2011; Stals et al., 2019).

Speculative design aims to envision alternative futures and provoke discussion. Green and colleagues (2023) suggest polyphonic speculation as a process to invite diverse responses and tackle complex challenges. While there are many studies which combine speculative design with participatory and collaborative approaches, this paper suggests participatory speculative design (PSD) as an enabler of polyphonic speculation. Therefore, this paper aims to explore how PSD approaches can facilitate the involvement of citizens in envisioning the future of public spaces and discuss their potential in policymaking within the context of connected places and public spaces.

2. Literature context

2.1 Place and sense of place

According to Lefebvre (2012), space is embedded in three elements: physical, mental, and social spaces. First, physical space indicates nature. Second, mental space includes logical and formal abstractions. Last, social space means social practices and social actions. He highlighted that these spaces include interconnected elements (Molotch, 1993). Lefebvre also argued a conceptual triad of space: spatial practice, representations of space, and representational spaces. First, spatial practices are from social formation, continuously constructed and reconstructed by human intentions such as daily routines. Second, representations of space indicate images and orders of space defined by others, such as architecture and urban places. Last, representational spaces are formed by the lived experiences of people in the places. Lefebvre's triad of space demonstrates how interconnected and complex social spaces are by nature (Lefebvre, 2012).

Sense of place is one of the intangible assets of space, which is people's choice of emotional ties and attachment to their lived place (Arefi, 1999). This intangible asset of the place fosters place stewardship and reinforces social solidarity and the well-being of individuals. Mattern (2003) states that design for public spaces should focus on understanding and realising these intangible assets rather than simply constructing physical structures. She also highlights the importance of engaging with people who can bring lived experiences regarding public spaces, as mentioned in Lefebvre's triad of social space. They can be designers, developers, civil servants, and citizens to understand the identity and dynamic of the place. Exploring sense of place in a participatory manner offers opportunities for discussion, for instance, about the implementation of emerging technologies in public spaces.

2.2 Polyphonic speculation and participatory speculative design

This section explores speculative design approaches with participatory settings that can reveal multiple perspectives of public spaces, including physical, mental, and social aspects. Speculative design is a future-oriented practice that foresees trends and reflects them (Sanders & Stappers, 2014). Dunne and Raby (2013) define speculation as imagining alternative futures critically. Their approach includes a 'what-if' question and projecting multiple scenarios which challenge people with their assumptions toward futures. It aims to explore and critically examine alternative futures and to expand individual's perspectives towards futures (Malpass, 2013). However, investigating how speculative design practices could embrace inclusive approaches to tackle social issues through speculative design.

Recent explorations of speculative approaches share the values of polyphony. Gerber (2018) states that participatory speculation combines participatory and speculative design practices by provoking discussion and debate about alternative visions. Participatory speculation activities include workshop-format events of speculative design to design and discuss alternative scenarios. Participatory speculation studies focus on collective contexts of ethics and politics highlighting the subject of ‘we’ rather than individual needs (Shklovski & Grönvall, 2020). Another terminology found in literature is collaborative speculation (co-speculation). Co-speculation is an emerging practice to involve individuals with expertise and particular knowledge to discuss a common inquiry. The individuals as co-speculators investigate collectively research questions and assumptions that the researcher shared. Co-speculation acknowledges the lived experiences and daily practices of co-speculators which can lead to shared experiences and insights (Wakkary et al., 2022).

Similarly, participatory speculative design (PSD) aims to engage with people, not necessarily designers or experts, in the speculative design process. Chopra et al. (2022) highlight that the value of PSD is to involve marginalised groups or those overlooked by mainstream design. They state that PSD is an integrative approach aiming to accomplish ethical and political action. This research focuses on the idea of PSD, as the term involves the design element, inviting participants to make, create, and prototype rather than simple consultations based on speculations and discussions.

3. Methodology

As explored through the existing literature, place consists of physical but also mental and social spaces where polyphony emerges. Based on this understanding, this study investigates how speculative design, conducted in a participatory manner, enables the collective reflection of the possible implementation of emerging technologies in public spaces. This research aims to experiment with participatory speculative design (PSD) approaches and examine their potential in policymaking. Thus, the methodology employs PSD as a process to create polyphonic visions collectively by involving different stakeholders. A summary of the methodology is described in the following table.

Table 1 Overview of Methodology

	Stage 1		Stage 2	Stage 3
Process	Workshop 1 & 2	Intervention	Public exhibition 1 & 2	A workshop with policymakers
Sampling (Number of participants)	W1 MA students (23) W2 BA students (31)	Researcher and 3D artist	General public (120)	Policymakers (3)
Methods	Place mapping What-if questions Prototyping speculation Storyboard building	Prototypes	Storyboard critiques	Place mapping What-if questions Prototyping speculation Storyboard critiques Policy process mapping
Outputs	Prototypes Positive and negative storyboards	Selected prototypes and storyboards 3D models	Feedback Design suggestions	Policymaking process Insights

3.1 Process

The research methodology followed a qualitative approach (Becker et al., 2012), including a PSD process consisting of three stages of data collection: two speculative prototyping workshops, two public exhibitions and a workshop with policymakers. The Faculty of Arts and Social Sciences (FASS) Ethics Committee at Lancaster University approved the study on the 14th of December in 2021. The workshops aimed to understand what participants imagine regarding implementing emerging technologies in connected places and to design alternative futures responding to challenges. After the workshops, the researcher collaborated with a 3D artist turning the results into 3D models, images and prototypes and transcribing the insights of the activities into accessible content for participants of the following activity. Then, two public exhibitions were held to present prototypes and insights and collect opinions from the wider community. The exhibitions were held for two days in a university library and then in a city museum to attract a large and diverse audience. Last, policymakers were invited to a workshop to investigate how PS can assist in policymaking for introducing new technology. The following sections provide a detailed description of the sampling strategies and data collection methods.

3.2 Sampling

In this research, more than 170 participants contributed to the PS process in different capacities. 54 people participated in Stage 1, 120 in Stage 2, and 3 in Stage 3. The selection of the sample and description of participants are described as follows.

Stage 1: Workshops

The purpose of the workshops was to collect the perspectives of students towards a place as newcomers as well as non-experts in digital technology. Thus, two workshops were conducted between November 2021 and January 2022 with university students in Lancaster. There are two rationales behind the decision involving students in Stage 1. First, the student population has been significantly influencing the local economy in the city (Fenton, 2022). Nevertheless, it is overlooked as an "invisible" population with limited opportunities to be involved in the decision-making processes of local government (Russo et al., 2003). Thus, this involvement was expected to be a valuable opportunity to reveal the future speculations of the invisible population to local policymakers. Second, since the workshops were planned during the COVID-19 pandemic, there were restrictions to recruiting participants for in-person workshops. A total of 54 students participated in the workshops. The first workshop involved MA Design Management students (23), and the second involved first-year BA Architecture students (31). The workshops were also designed to form part of the teaching activities for the relevant modules. With the participants' consent, the researcher was able to use their outputs for the further research process.

Stage 2: Public Exhibitions

Two public exhibitions showcased prototypes from the workshops and aimed to gather feedback from a wider audience beyond Lancaster University to capture users' opinions of the public spaces. Exhibition 1 was held at a university campus a few miles from the city centre and was visited by 60 people. Then, Exhibition 2 was part of a national Festival of Social Science and was held at the City Museum, located in the heart of the city. It was advertised nationally and received around 60 visitors of all ages over two days. Because the two exhibitions took place in different contexts, Exhibition 1 mainly attracted students and university staff, while Exhibition 2 drew in families and residents. By conducting these exhibitions, it was possible to engage with a wider range of participants including members of the staff and students from Lancaster University and city residents from young children to elderly people.

Stage 3: Workshop with Policymakers

In Stage 3, a workshop was planned to invite three Lancaster City Council officers. The workshop explored how the PSD methods could help policymakers understand the public's expectations, visions, and fears of connected places and where they can be used in policymaking.

3.3 Methods

Workshops with Students

The workshops used a local strategy written by the County Council titled the City Centre Movement and Public Realm Strategy as the context of the workshops. The strategy aimed to boost sustainable transport and housing supply in the central area by demonstrating images of how public spaces would look. The strategy consisted of five themes: inclusive environment, ease of movement, quality of place (public realm), safety and public health, and economic benefits. However, it was questionable how properly the strategy represented users' needs and aspirations due to the absence of any reference to digital technology. To address this, the workshop used the strategy to generate future prototypes and scenarios utilising digital technology in public spaces in Lancaster. The workshop used three themes from the strategy as design challenges in the speculation process. Themes such as the 'ease of movement' were eliminated because they rely on physical and infrastructural changes rather than digital implementation. These challenges aim to help the participants set a boundary of speculation rather than being aimless. The three challenges are the following:

- How can this place be more inclusive for vulnerable users?
- How can this place be safer for the community?
- How can this place be more liveable and attractive for locals and tourists?

Before the workshops, an online questionnaire was sent to the students to complete. It aimed to evaluate their understanding of connected places as a concept and the systems and devices related to them. The devices and technologies include wearable devices, IoT and edge computing (NCSC, 2021). The insights gained from the questionnaire informed the researcher to design the workshops and set facilitation strategies.

The workshops were structured into three activities, including a 15-minute presentation. The presentation offered an overview of connected places, systems and devices and introduced the strategy describing the city's future. Then, the students worked collaboratively on three challenges based on the five themes of the strategy that resonated with local issues and the implementation of digital technologies. During the workshop activities, the students worked in groups to use three methods supported by tools prepared by the researcher. These methods included exploring the present (place mapping) and the future (what-if questions and speculative brainstorming) and two story-building activities focusing on positive and negative futures.

Method 1. Place mapping

The method, place mapping, was designed to enable participants to describe place-based knowledge, experiences, and emotions. The outputs of this activity became the essential inputs for the next step of speculating future implementations of connected places. The tool consists of two parts: (1) a grey-scaled picture of a public space with a map and small pic-

tures with different angles of a particular place and (2) a tracing paper (Figure 1). For the activity, the students were asked to choose one of the four public spaces which were described in the County Council's Strategy. Subsequently, participants were invited to capture in the tracing paper the appearance, activities and feelings related to the place. This activity enabled them to make sense of their knowledge of the place and build a collective understanding of it for the next activity(Zuckerman, 2019).

Methods 2 and 3. What-if questions and Speculative Brainstorming

In the second method, the researcher prompted the participants to imagine a time travelling experience to take them ten years into the future. Then, the researcher asked hypothetical "What if" questions to imagine possible futures, to design speculative scenarios and prototypes (Dunne & Raby, 2013)and to imagine what would happen in that situation (Tsekleves et al., 2017). At this point, two "What if" questions were asked: What if everything collected data? And, what if everything was digitally connected? For this purpose, through a speculative brainstorming activity (Method 3), participants were asked to use a new sheet of tracing paper to represent potential technological applications within the public spaces. In a metaphoric sense, tracing paper represented the imperceptibility of digital technology. In other words, the technology that has been invisibly and pervasively embedded in or added to the pre-existing environment (Ampanavos & Markaki, 2014). In doing so, participants could replace or overlay the 'present' paper from the place mapping and reflect on the differences between present and future scenarios.

Figure 1 The interactive tools for Method 1 and 2

Method 4. Story building

For this activity, the researcher asked the participants to select and describe one idea from the speculative brainstorming. Then, a storyboard tool was provided for them to focus on and build a narrative of their ideas. First, they had to work on a positive scenario and then a negative story of the selected concept. The tool was printed on large sheets of paper, which allowed the participants to work on the storyboard collectively (Figure 2).

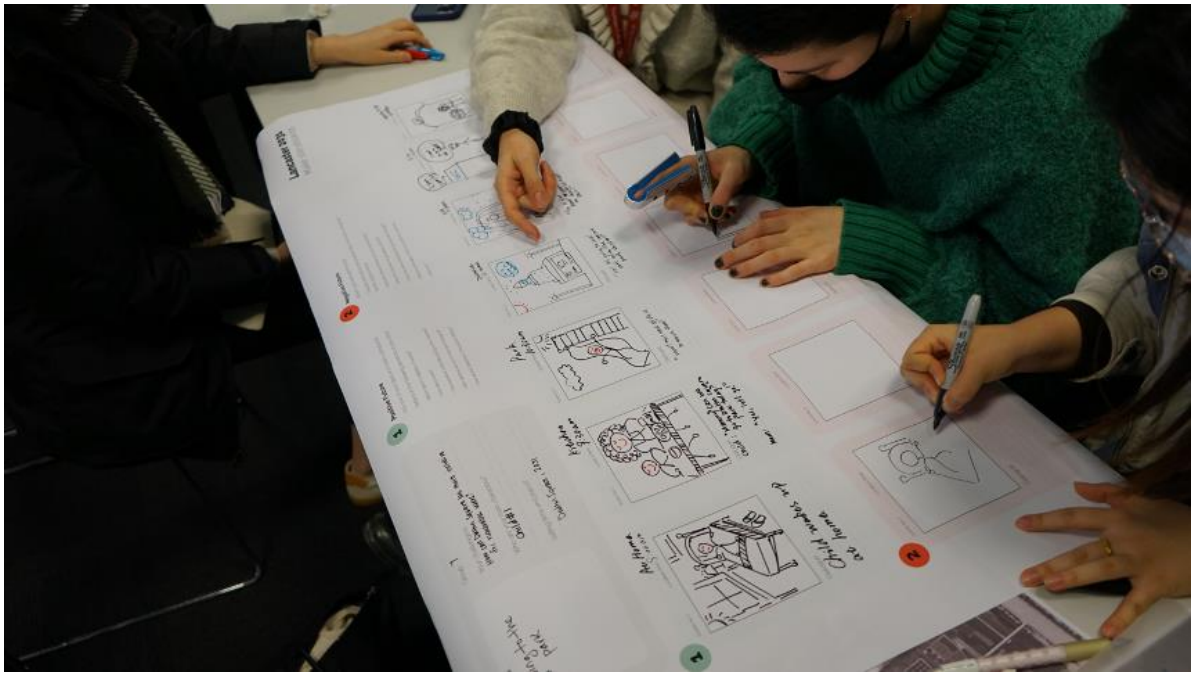

Figure 2 The storyboard tool

Intervention by the researcher and the 3D artist

After the workshops, the researcher collaboratively worked with a 3D artist to generate the exhibition's final prototypes. In total, 22 potential prototypes were identified, each with two storyboards describing positive and negative futures. Six were selected because they are highly relevant to the connected technology. Also, it was considered whether the idea engaged with more than one technology. Some ideas were combined based on similarities. Figure 3 presents the finalised version of the 3D rendered images and descriptions of the six prototypes.

Figure 3 3D rendered images and descriptions of the six prototypes

Public Exhibitions

The exhibition focused on one public space, Dalton Square, instead of the four places to simplify the information for visitors. The reason behind the decision is the attribute of the place described by the participants. They illustrated different events in the place such as local farmers' markets during the pandemic and setting up ice-skating rinks and a Ferris Wheel in

winter. The active and multiple uses of the space would help people to imagine the place with different occasions.

Each prototype was presented in the exhibition along with posters describing the ideas, rendered images, and storyboards. The positive and negative storyboards were presented with the title, 'The story of [prototype's name]', and 'What if it works differently than what you expected?' The posters and 3D models enabled the visitors to see the speculative prototypes and how they work in [Square name] and to discover what might happen if they do not work as expected. At the bottom of the poster, three main questions were asked:

- Are you happy to have this technology in [Square name]? (Yes/No)
- If yes, could you tell us why you will be happy to have this technology? If not, what are you concerned about this technology?
- What would you like to change/add to this technology?

The first question was a yes-no question, so the visitors could respond to it by placing a dot in the yes or no answer space. The other two questions are open questions in which the visitors could write their comments on sticky notes and place them on the poster. In addition, there was a sign placed at the entrance to inform and encourage the visitors that the exhibition was interactive so that they could draw and write freely (Figure 4).

Figure 4 Exhibition 1 (left) and Exhibition 2 (right)

Workshop with the Policymakers

After the exhibitions, a workshop was delivered to demonstrate some PSD methods to policymakers and showcase prototypes and feedback from the public. Also, it aimed to explore which areas of the policymaking process these methods could be applied. The workshop consisted of four parts: a kick-off presentation, two hands-on activities similar to those used in the workshops of Stage 1, a discussion of current policymaking processes and a final in-depth discussion. For the first discussion, a tool was designed to map the action points of the policymaking process. Then, the policymakers were asked to mark with stickers the points

where they thought these methods and activities might be helpful (Figure 5). The final discussion explored the challenges to using these methods and the policies that can be affected in the future using these methods.

Figure 5 Mapping a policymaking process and PS activities and methods

The limitation of this study is that it was conducted from 2021 to 2022, a time frame was directly influenced by the Covid-19 restrictions. Participant recruitment was restricted in scope and the approach to interacting with participants was also limited.

4. Findings

As described above, the project includes three stages employing the PSD approach to generate multiple views of places from participants and meaningful insights for place-based policymaking. This process uncovers (1) the challenges associated with PSD, (2) the ways in which PSD methods help participants to express issues in public spaces that they have previously neglected, (3) the role of place in PSD, and (4) the usefulness of PSD in creating polyphonic narratives for futures of connected places.

4.1 Challenges for different individuals

Different challenges emerged throughout the project, such as familiarising participants with the uses of digital technology in connected places and encouraging participants to interact with the future by going beyond their professional and sentimental attachments to the places. First, to develop speculative prototypes it is essential to generate a common understanding of the technologies to be considered in the prototypes. Stage 1 participants were students with design management or architecture without expert knowledge of speculative

design and connected technology. Based on the results of a baseline questionnaire, participants indicated they had a low level of understanding of digital technologies and connected places. For this reason, the researcher started the workshops by introducing these concepts through a short presentation. Due to the duration of the workshop, ensuring the participants understood it in-depth within a limited time was challenging. Nevertheless, the short presentation enabled participants to speculate using notions of connected places and digital technologies that were reflected in their ideas.

Moreover, participants' professions and practices can limit the process of imagination and speculation in PSD. During the workshop of Stage 3, the participants who are policymakers expressed their difficulty in thinking beyond their professional backgrounds or roles as local authorities. When asked to imagine and speculate futures in places, they said it was challenging to think beyond current rules and regulations when considering future deployment. They also highlighted that the current practice of crafting new policy agendas is to study other councils or third-party proposals rather than engage with creativity or imagination. Thus, this finding highlights the need for involvement from diverse groups of people to imagine alternative possibilities for public spaces.

Lastly, sentimental values can influence the outputs of speculative prototyping. Again, in Stage 3, it was observed that the policymakers had a strong attachment to the place as they frequently described how many positive memories they had. This sentimental value led to the limitation of ideating speculative prototypes. When the researcher asked to imagine the technology implementation, they did not want to change anything because they liked the place as it was. As a result, they spent more time coming up with ideas and developed fewer ideas than the students in Stage 1. This indicates that polyphonic speculations can include visions of remaining stasis as well as status quo.

4.2 Articulating issues

PSD methods can enable people to identify and articulate issues in public spaces. These spaces are constructed and reconstructed by people's interactions within them. The spaces are also reconstructed through their use, reflecting the lived experiences of those who utilise them (Lefebvre, 1991). By employing PSD methods, participants can reflect on public spaces and their lived experiences. As a result of these reflections, participants may perceive and represent public spaces in diverse ways, influenced by their varying degrees of attachment or ownership to these spaces. The methods utilised in this research allowed participants to talk about current issues and anticipate potential problems that might arise from introducing new digital technologies. For instance, in Stage 3, during the place-mapping activity, a participant commented, as a joke, on the existence of rats in Dalton Square, which led her to recognise a mundane issue that she had previously overlooked. This articulation of overlooked issues within a public space led to the generation of ideas to address the problem.

4.3 The relevance of the place in PSD

In the intervention stage by the researcher and the 3D artist, the researcher selected six prototypes generated from the workshops. Some prototypes were relocated to Dalton Square even though they were designed for other places. This change enabled the researcher to test to what extent the technological ideas suggested by the students are linked to place identities. For instance, most visitors disliked the idea of the Smart Mirror, which can assist people in buying clothes by providing a virtual try-on. They pointed out that this fictional technology needs to be aligned with the place's identity, because Dalton Square is considered a historical place rather than a high street. In fact, the Smart Mirror was designed for another place in the centre of the city, surrounded by local shops and restaurants. If the mirror was placed in the high street, the responses might have different reactions. In contrast, the Smart Statue was selected as the most preferred technology designed for the place. The idea consisted in applying smart technology to the statue of a historical figure. The statue could interact with people, providing local histories and information such as weather forecasts. In both exhibitions, most participants welcomed the technology in the place. Participants suggested that this technology would help both residents and visitors to know more about the history of the place. Additionally, they anticipated that the statue would enhance Dalton Square's place identity by engaging with a historical figure, Queen Victoria, instead of being a static statue.

4.4 Polyphonic speculation reflecting multiple world views

The findings of this study present the potential of PSD as a way of facilitating conversations among various groups regarding technology implementation. First, in Stage 1, it was observed that different disciplines might provide different worldviews. Workshop 1 participants with design and management backgrounds created ideas about products and services. In contrast, Workshop 2 participants, first-year architecture students, focused on sustainability and green space. Furthermore, selecting the challenges for the places depends on different attention by participants. For example, most students chose Challenge 3 to make a place more liveable and attractive, whereas little attention was given to Challenge 1 to create a place inclusive and Challenge 2 to make a place safer.

The process of PSD allows participants to express what they think, imagine, and feel about future technology in their mundane spaces. In Stage 2, the public exhibitions enabled the researcher to collect multiple critical comments about the prototypes. The comments could be used as prompts to develop more scenarios describing the potential impact on places and people with different conditions and behaviours. In the case of Smart Statue, even though most visitors welcomed the deployment, a critical and unexpected comment was made on the potential risks for people with mental health conditions. The result suggests that diverse perspectives are helpful to understand the place and to shape the place's future. Insights gained through engagement from different groups of people may inform policymaking processes by considering aspects that policymakers have yet to foresee, researchers and designers.

Moreover, PSD offers an opportunity to reflect on other views which constitute polyphonic speculation. Interestingly, the researcher observed constructing dialogues between participants in different ways. For instance, visitors paid attention and replied to the comments of the previous visitors by agreeing, disagreeing, or questioning the comments based on their lived experiences and imaginaries of the place inquired.

5. Discussion

5.1 Place-based approach for Polyphonic representation of place

Ensuring an environment for polyphonic narratives would be essential to understanding a place entirely. Public spaces are interconnected with multiple individuals and stakeholders who share responsibilities. Moreover, if one implementation happens in public spaces, it will affect these dynamic relationships. In Stage 3, it was challenging to manage public spaces for policymakers because of their sense of ownership and attachment to the spaces. Therefore, it is arguable that simulating alternative scenarios through polyphonic speculation is vital to represent different individual perspectives.

As explored in literature and through research, PSD can help build collective insights about technological futures by involving diverse groups of individuals. In particular, this research enabled the participants to design their speculative prototypes as a group by using their intangible assets in a place and interpretations towards technology. Reflecting on their assets here includes experiences, feelings, and observation in a place. The imaginary prototypes related to places were highly relevant to the experiences of the place and played a role in polyphonic speculation as a prompt arousing sympathy and discussions. This insight reveals the importance of taking intangible social assets of place into polyphonic speculation. As argued in the literature, the decisions for a place are often made in a top-down process, and there are risks that those decisions are not fully reflective of local needs and challenges. Each physical place has different geographic conditions, individuals, communities, history, and cultures. The lack of understanding of places may cause more challenging wicked problems where digital technology implementation can be the cause of the problems rather than innovative solutions. By enabling individuals to reflect on their experiences and practices in place, PSD approaches have the potential to generate polyphonic narratives to embrace diverse perspectives of the place. Integrating polyphonic views can be vital in fostering more bottom-up inputs to placemaking and helping policymakers understand the place better.

5.2 PSD and Polyphonic speculation on policymaking

PSD enables polyphonic speculation by involving people to create their own narratives and build collective imaginary futures. The focus of this research was technological implementation for connected places in public spaces. The primary goal was to understand dynamic perceptions of the context from people rather than to ideate innovative and comprehensive solutions. This is because digital technology and its systems are complicated and require professional knowledge and expertise. However, again, the perceptions revealed by polyphonic

speculations are significant inputs to tackling the challenges and generating solutions by enabling experts and decision-makers to understand the place and people's needs. This research shows how PSD methods can help people articulate current ongoing issues that have affected them directly but also unnoticeably and the potential issues that might happen. This PSD method can be more beneficial than individual interviews or consultations as it allows trigger dialogues to share the place's perspectives and interpretations to reveal the needs of the place.

The discussion with the policymakers reveals the potential area of PSD methods in policymaking at the early stages of defining policy agendas and formulating policies. As PSD enables the creation of speculative prototypes that reflect multiple views, this approach can be helpful for policymakers in setting more inclusive policies. Moreover, polyphonic speculation is valuable during policymaking because it can multiply different scenarios that policymakers should consider before policy implementation. It can be used internally within a team in an organisation and externally with external partners, stakeholders, and members of communities. Overall, this research revealed that PSD and polyphonic speculation are valuable in facilitating citizens' engagements, which become essential assets for policymakers. This indicates that PSD and polyphonic speculation should be actively employed in policymaking and public sectors in urgent and emerging contexts, such as net zero. Nevertheless, more research is required to further explore the impact of these approaches on policymaking.

6. Conclusion

While places are interconnected with tangible and intangible elements, including physical, mental, and social spaces, the transition of digital technology has reshaped spatial experiences and practices. However, because of the complex interconnectivity, policymakers have faced the requirements for more inclusive and reflective approaches in policymaking. This research employed PDS to generate a holistic but plural view towards public spaces and to examine how this approach can be applied in policymaking. It conducted workshops with the university students, public exhibitions inviting the public, and workshops with policymakers. As a result, this research reveals the challenges of conducting PSD activities, the benefit of PSD in articulating issues, the context of place in PSD, and PSD as an enabler of polyphonic speculation to reflect on multiple world views of people. First, the discussion section reveals the importance of polyphonic speculations as a place-based approach. Involvements of individuals to build speculative prototypes reflect on their lived experiences and practices in places. The polyphonic views can contribute to creating a holistic picture of the place. Second, the potential of employing PSD in policymaking was discussed to create speculative prototypes. However, the aim of PSD is not to generate solutions but to understand the dynamic of the contexts (public spaces in this research). Thus, the methods can be used in the early and during the policymaking process internally and externally. Further studies should explore how local and lived experiences can be acquired by recruiting a wide range of stakeholders in the speculation and prototyping of future public spaces. Moreover, further exploration is required to determine how policymakers can use those insights to make policy in

different contexts, including emerging technologies and other urgent matters that need inclusive but multiple voices.

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