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Making Deliberation Affordable: Deliberative Affordances of Situated Digital Citizen Participation Technologies

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Abstract

With the consolidation of the field of city science technologically and intuitionally, there is a growing need for complementary research on its social aspects, uses, and dilemmas. Public participation and dissemination of technological advancements in the Smart City is one seminal example. Deliberative processes in public participation in urban design and decision-making focus on making decisions based on argumentation and a shared notion of the common good (Cohen, 2005), instead of aggregating prefixed preferences as large-scale digital participation platforms frequently do . However, empirical research has shown that deliberation processes risk failing due to challenges of communication and comprehension (Bächtiger and Beauvais, 2016). As deliberation is based on the presentation of arguments, different gaps in subjects' positions and backgrounds lead to unequal opportunities to shape deliberative processes (Rosenberg, 2007, 2014). We argue that the informed use of specific technological devices here referred to as situated digital citizen participation technologies, can mitigate inequality in deliberative citizen participation practices. We inquired into the Smart Social Strategy Lab (henceforth 3SLab), a deliberation-supporting technology from the Technion, to conceptualize how this type of participatory technology affords inclusion in deliberative processes. The 3SLab is an interactive visualization theater in which a video projection on a concave wall and an interactive touch table create an immersive and interactive shared space by simple means. Through a qualitative reflexive study on the experiences of participants in a technologically facilitated participatory process on the state of elderly citizens in the Haifa neighborhood of Hadar, we find that situated digital citizen participation technologies can support deliberation through two distinct technological affordances. Firstly, the 3SLab provides an immersive shared space that improves communication and mutuality. Secondly, interactive visualization techniques afford improved comprehension of complex urban issues. The two affordances co-constitute each other in integrating and confirming tacit and perceived knowledge with visualized and spatialized data, allowing the inclusion of a wider range of experiences and subject positions within deliberation. The study indicates avenues for future research on deliberation-supporting technologies by proposing a dual focus on (1) immersive and shared spaces and (2) interactive visualization techniques.

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1. Introduction

Deliberation and a deliberative democracy represent a particular model for democratic decision-making that guides citizen participation in design processes through informed, reasoned, and intellectually honest debate (Bächtiger et al., 2010; Cohen, 2005; Steiner, 2018). Rather than drawing on possibly polarized, large-scale polls, and referenda, participatory policy-making increasingly ought to focus on involving small groups of citizens for the "diagnosis of democratic ills and the development of effective responses to the contemporary crisis of democracy" (Dryzek et al., 2019: 1145). As an ideal form of democratic governance, however, deliberation depends on "means to engage individuals and organizations outside government through […] institutional arrangements that facilitate supportive collaborative-based discursive relationships" (Fischer, 2012: 458). This way, deliberation fosters more trust and transparency between public stakeholders and decentralizes decision-making processes (Fischer, 2012). Contrary to ideal forms established in deliberation theory (Cohen, 2005), empirical research on deliberation has shown that many citizens lack the sufficient means to engage in deliberative activities (Rosenberg, 2014; Bächtiger and Beauvais, 2016; Gerber et al., 2018). Over the past years, a wide array of online participation tools has been created to remove obstacles preventing from citizens engaging in participatory processes (Deseriis, 2021). However, due to persisting digital and other divides, the results of using online digital participation platforms to ease the participation of socioeconomically disadvantaged populations have been mixed (Pearce and Rice, 2017; Sylvester and McGlynn, 2010).

In the present article, we argue that an informed and carefully designed use of situated digital participation technologies can afford (better) deliberative practices. These situated digital technological devices are distinct from online platforms in that they use digital technology in a place-specific way, primarily aimed at supporting face-to-face participatory processes. These may include any platforms of data visualization and spatialization (GIS) as well as interaction interfaces such as digital sand-tables, used by a group in one dedicated site. Like any technology, such participation technologies are not neutral instruments. Participation technologies rest on assumptions of user behavior and interactions between users are designed to promote corporate narratives (Sadowski and Bendor, 2019), as well as produced by and inevitably reproduce biased taxonomies (Benjamin, 2019; Chun, 2021). As non-neutral devices, participation technologies may constrain the interactions and actions that are carried out through them, and thus restrict the potential of deliberation.

We build on the notion of *affordance* to describe the complex relationship between an "object/technology and the user that enables or constrains potential behavioral outcomes in a particular context" (Evans et al., 2017: 36). Technological affordances frame, but do not dictate, the users' possibilities for action. We thus examine the situatedness of several technologies in the context of improving deliberative practices as means to intensify the desired affordances (i.e. better deliberation) of otherwise potentially limiting existing technologies. In other words, our research asks how and to what extent can situated digital participation technologies afford improvements in deliberation practices.

We address this research question by drawing on empirical evidence from a participatory process on the subject of elderly citizens, conducted by the Smart Social Strategy Lab (3SLab)

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of the Technion in the city of Haifa, between January and November 2021. The 3SLab is a unique oval-shaped interactive visualization theater (Edsall and Larson, 2006; Orenstein et al., 2015). It is designed to accommodate participatory design, data-based management, decision-making, public participation, and deliberation. The 3SLab consists of a (1) digital twin of the neighborhood and a (2) touch table, that enables the stakeholders to communicate through interactive literacy. Although the complexity of both of these technological elements is central to the case study, the scope and focus of this research do not allow to discuss them separately in detail. The reflection and analysis of the findings we provide address the combined affordances of the various technologies that make up the 3SLab as one technological apparatus to which the informants respond. The article's findings draw on participants' feedback on their personal experience of the work in the 3SLab.

The analysis of the work-sessions transcripts and semi-structured interviews shows that the use of technology substantially shaped the quality of deliberation processes through two main affordances: (1) sharing an immersive space, and (2) interacting with visualized data. Based on a theoretical and empirical analysis, we argue that situated digital participation technologies generate affordances that, depending on their particular set-up, reduce communicative and cognitive shortcomings which are linked to failures in implementing deliberative processes. The two types of affordances we define correspond with two major deficiencies that, according to Rosenberg (2007, 2014), commonly characterize deliberative processes. For one, situated digital participation technologies can represent a shared immersive space that reduces communicative shortcomings by easing empathetic and respectful communication among participants of deliberation. For another, situated digital participation technologies can afford a better comprehension of complex urban issues through interactive visualization of urban data and by that bridge gaps in knowledge between participants and between different kinds of knowledge (professional, experiential, tacit, etc.).

Our study primarily contributes to the fields of *urban design and city science*, by inquiring into how digital participation technologies, that draw on the analysis of big data and visualization techniques, can contribute to improving participatory design and governance processes. By investigating how citizens using participation technologies perceive and react to the technological affordances of such technologies, we advance knowledge on how the interplay of data, software, and hardware consciously and unconsciously structures participants' cognition and behavior. Additionally, we explore how participants engage in improving participation technology when given the opportunity, for instance by curating data and suggesting improvements to soft- and hardware. By theorizing "deliberative affordances" this research contributes to two decades of literature on deliberation in the context of modern digital participation technologies. It provides a productive intervention into the *studies of participatory governance and democratic innovation* by discussing the potential of technological solutions to improve deliberation.

The following section of the paper conceptualizes deliberation and reviews the major shortcomings that make successful deliberative citizen participation difficult to put into practice. The third section conceptualizes situated digital participation technologies in distinguishing them from online digital participation technologies. In the fourth section, we

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present the case study and outline the methods used for the empirical exploration presented in the fifth section. The sixth section lays out the two types of affordances through which situated digital participation technologies can reduce communicative and cognitive shortcomings, which are linked to failures in implementing deliberative processes. Lastly, a seventh section provides a discussion of the tensions between our conceptualization and empirical verification and concludes with suggestions for further research.

2. The Shortcomings of Realizing Deliberative Processes

Deliberation rests on the idea that democratic processes ought to focus on communicating preferences, rather than merely aggregating their prefixed choices (Bächtiger et al., 2010: 35; Ryfe, 2005). Deliberation-based citizen participation processes differ from referendum-style citizen participation processes in centering an argumentative aspect of decision-making (e.g. Pogrebinschi, forthcoming). In short, a deliberative approach to public decision-making means that "collective decisions require justification to those subject to these decisions in terms that, on reflection, these individuals can accept." (Dryzek, 2001: 14). Implementing deliberation-based citizen participation is linked to the hope of overcoming the polarization of democratic systems (Dryzek et al., 2019) by rejecting models of democracy that focus on the quantitative aggregation of preferences (Thompson, 2008: 498).

However, assumptions about citizens required for successful deliberation are deemed by many scholars overly optimistic (Rosenberg, 2007). Sorial and Peterson contend that "deliberative citizenship […] requires particular knowledge, skills and dispositions" (Sorial and Peterson, 2019: 25). Contrasting the assumptions of deliberation theorists (Cohen, 2005), Rosenberg (2007, 2014) identifies major obstacles to the capacity of citizens to participate in deliberation. For one, participants often fail to *communicate* in a way that allows them to mutually grasp each other's perspectives on the issues at hand. As Rosenberg puts it, participants fail to "use talk to work collaboratively with people who have differing points of view" (2014: 99–100). For another, Rosenberg finds that participants frequently demonstrate prejudices, beliefs, and experiences that make "judging the means and ends of different courses of action" difficult (Rosenberg, 2014: 99). Other scholars paint a more nuanced picture of deliberative processes. Ryfe maintains that while "not easy", deliberation is "a natural human capacity" that requires a mixture of "knowledge/skills, motivation, and civic identity" to be successful (Ryfe, 2005: 63). Gerber et al. use qualitative measures to refute Rosenberg's claims, contending that most participants have high "deliberative abilities […] ranging from justification rationality to common good orientation, respect, empathy, and inquisitiveness" (Gerber et al., 2018: 1113). Yet, even they acknowledge that the capacity for deliberation is linked to a participant's socio-economic status, possibly creating a socially unjust bias in outcomes of deliberative processes (see also (e.g. Swyngedouw, 2005).

Actively addressing failures of communication and comprehension in deliberation is thus a prerequisite for a more inclusive deliberative process. Facilitation of deliberation aims at overcoming or at least mitigating the deficiencies that participants face. Bächtiger and Beauvais point out that facilitated deliberation aims at guaranteeing that "all sides of the debate are heard" (Bächtiger and Beauvais, 2016: 10). For instance, the "formation of positive socio-emotional relationships among the participants" aims to address communication failures by

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assigning "tasks [that] should involve individuals working together as equals for a commonly valued goal" (Rosenberg, 2014: 115). Facilitators are also expected to actively provide information to the participants to ensure that "all stakeholders [have] equal and fair opportunities to be informed" (OECD, 2020). Well-facilitated deliberation is aimed at allowing participants to both communicate and have an "understanding of the main competing arguments and their implications" (Fishkin, 2021: S20).

3. Technological support for deliberation

Our understanding of situated digital technologies stems from the growing critique of digital participation technologies. Over the past decades, numerous digital technologies have been developed to support, scale, or improve participatory processes, including deliberative ones. A broad variety of individual technological solutions seek to support participatory processes in variegated ways. The solutions include, but are not limited to participatory platforms (Anttiroiko, 2016; Deseriis, 2021; Peña López, 2019; Royo et al., 2020), "open government" transparency portals, participatory film-making (Manuel and Vigar, 2021) interactive "touch tables' that visualizes urban data (Baeza et al., 2021).

We distinguish between two major types of technologies: (1) online digital technologies, such as platforms, websites, and datasets, and (2) situated digital technologies. Online digital technologies have proven effective in enabling an ever-greater number of citizens to participate in urban design and decision-making processes (Anttiroiko, 2016; Deseriis, 2021; Peña López, 2019; Royo et al., 2020). Digital participation platforms, such as U_CODE, DIPAS, Adhocracy, and Decidim (Kneuer, 2016; Soltani, 2019) represent a rapidly increasing field of application of e-democracy (Hennen et al., 2020). Such platforms focus strongly on expanding access to participatory processes by facilitating asynchronous and low-cost participation through online digital participation (Deseriis, 2021; Jankowski et al., 2019). Whilst some platforms, such as Barcelona's Decidim, increasingly manage to foster deliberation online Bor (Bravo, 2019), most debates taking place on these platforms remain brief and characterized by radically opposing opinions rather than by a search for common ground (Aragón et al., 2017). Moreover, online digital platforms frequently involve individual citizens(Lin and Benneker, 2022) as the source of (quantitative) data rather than as stakeholders with complex (qualitative) opinions that are capable of participating in collective decision-making. Thus, most digital participation platforms seem to be either focused on gathering individually formulated and undebated proposals of the biggest possible group of citizens and/or on pursuing an aggregative model of democracy with referendum-style voting processes and citizen data mining.

Situated digital technologies on the other hand mobilize digital technologies and link them to physical infrastructures, such as screens, projectors, interactive touch-tables, sensors, and dedicated spaces. This type of technology is commonly used by individuals or in a town hall meeting-type of deliberative participatory processes. In contrast to online processes, situated formats of participation have the benefits of being "an opportunity for face-to-face interaction, a real-time setting for an argumentative discourse, and an opportunity to create social bonds and trust" (Jankowski et al., 2019: 512). In practice, the integration of online and situated digital technologies is possible and has been demonstrated on multiple occasions. U_CODE and DIPAS systems, for example, cross-connect far-reaching digital participation platforms with

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the local situated digital technologies used in face-to-face deliberation workshops (e.g. Thoneick, 2021). These integrated systems feature custom-tailored data pipelines and interaction processes (Noyman et al., 2017). However, current literature focuses almost exclusively on digital participation platforms, framing them as almost synonymous with digital participation supporting technologies (see e.g. Deseriis, 2021). Therefore, there is a need for a proper understanding of the widespread existence, use, and affordance of situated digital technologies within the literature on participation technologies and their relevance for improving deliberative processes.

4. The Case Study: Citizen Deliberation in the 3SLab

The 3SLab follows the VR model of CAVE (Cave Automatic Virtual Environment; different from a head-mounted VR display worn by the user), in which the real environment is "augmented" by a virtual (computer graphic) display in a closed room (Hanzl, 2007; Mitasova et al., 2012; Portman et al., 2015). It is an oval space of 34 square meters, with 8 meters long and 3 meters wide video projection on a concave wall and surround-sound speakers (see figure 1). The 3SLab includes a Digital Twin system (Batty, 2018; Dembski et al., 2020; Ruohomaki et al., 2018) - a digital 3D model of the Hadar neighborhood, in Haifa, Israel, which allows spatial representation of multiple layers and forms of data. The 3SLab also includes an interactive touch table that is located at its center (see figure 1). Inspired by the military sand-table and later the electronic sand table (Wisher et al., 2001), it provides "integration of computer application, visual reality, GIS, virtual reality and multimedia […] [for] real-time interactive operation" (Wang et al., 2005). The scope and focus of this research on deliberative affordance of participation technologies do not allow for an in-depth discussion of the neighborhood digital twin or the touch table independently.[1] Recent experiments with participatory planning processes that were conducted at HafenCity University Hamburg and TU Dresden relied successfully on interactive touch-tables as their key technology (Noyman et al., 2017; Stelzle et al., 2021). The 3SLab also includes cameras and sound condensers that allow documenting the activity in the lab for research or broadcasting purposes.

[1] Neighborhood digital twins are discussed in detail elsewhere (e.g. Yosef-Ravid and Aharon Gutman, under review; Yosef-Ravid et al, under review).

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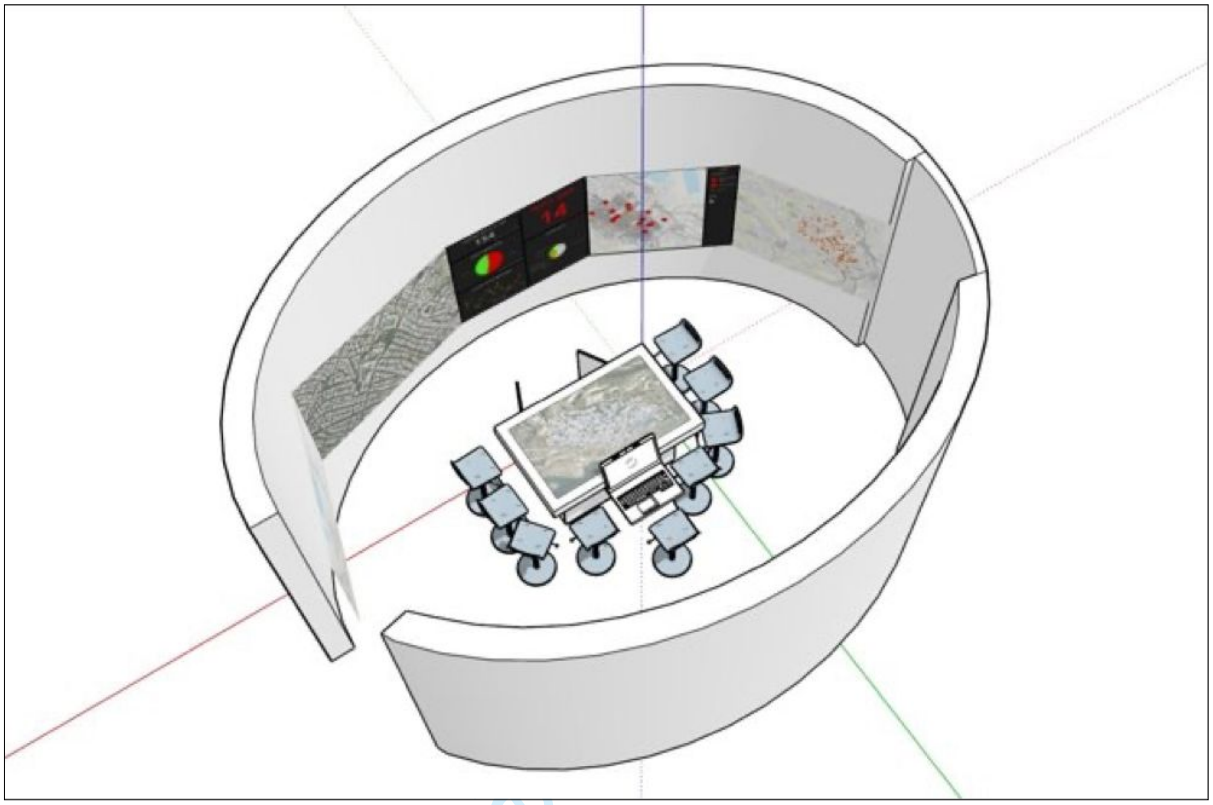

Figure 1: Proportional drawing of the Smart Social Strategy Lab. Drawing by Arch. Bat-El Yosef Ravid

As part of its vision of community engagement, the 3SLab is not located at the Technion's main campus, but in the Haifa neighborhood of Hadar. Hadar has an exceptionally large proportion of elderly, low-income citizens and suffers municipal neglect and high crime rates. The case study we used in the research on the deliberative affordance of situate digital citizen participation technologies is a 3SLab-initiated process aiming at producing tangible improvements to the current state of elderly citizens in the Hadar neighborhood.

Over the course of one year, representatives of the community of elderly citizens, municipality officials, and civil-society community organizers met at the lab regularly to use its various technologies. The empirical data is derived from two sources: (1) transcripts of the working sessions of the participatory process on the state of elderly citizens (table 1), and (2) semi-structured interviews with 8 participants, combining first and third sector agents: social workers, community activists, and highly involved citizens (see table 2 for details on each interviewee). We distinguish this sub-group of participants from elected or executive municipal decision-makers on one hand, and from the general public on the other. This grouping was chosen because it includes the majority of the platform's participants and also because it allows for the examination of deliberative affordance from the intermediary position of people who simultaneously serve as the face of the establishment for the public and the advocates of the public's voice and needs in institutional municipal forums. All members of the examined sub-group of stakeholders have first-hand unmediated knowledge of the everyday lives of elderly citizens in the neighborhood. This often tacit and intuitive knowledge was compared during the process with statistical data, large-scale infrastructure, and other urban development plans.

Table 1: List of sessions that formed the participatory process at the 3SLab

S	Session Date	Session Number	Content of Working Session
1	17/3/21	1	Individual exploration of Digital Twin
2	13/4/21	2	Collective work within DTC
3	30/5/21	3	Tour – facilitated by the group members from the Department of Welfare and residents
4	29/6/21	4	Discussion and proposition of solutions
5	11/28/21	5	Each stakeholder suggested an "action" relevant to their level of responsibility / involvement. Discussion about how to integrate the different actions.

5. Research Design and Method

Our qualitative data consists of the iterations and reflections of participants on their personal experience of the combined effect of the technological apparatus of the 3SLab. The group consisted of adults from a range of ages, both women and men, Jews and Arabs, who participated voluntarily and gave a signed consent to be recorded during the session by the cameras and microphones installed in the 3SLab. Each working session conducted in the 3SLab (with the exception of Session 3 that was a tour in the neighborhood) was two to three hours long and had a specific topic and goals (see sessions in table 1). The 8 participants we interviewed after the completion of the process were present in at least three of the working sessions and gave a signed consent to be interviewed (see table 2).

Table 2: List of interviews sources

I	Interview Date	Interviewee Profile	Sessions Attended
1	12/26/2021	Female, Charity CEO	1,2,4,5
2	12/26/2021	Female, Elderly Citizen Dpt.	2,3,4,5
3	12/26/2021	Female, Social Worker	1,2,3,4,5
4	12/28/2021	Male, Municipal Community Work Coordinator	1,2,5
5	02/03/2022	Female, Community Organiser	1,2,3,4,5
6	02/03/2022	Male, Elderly Citizen Activist	1,2,4,5
7	23/03/2022	Female, Community Organiser	1,2,3,4,5
8	24/03/2022	Male, Social Worker, Co of Welfare NGO	1,2,3,4,5

A qualitative research method attending to specific choices of language and metaphors used by participants was applied to best address the nuances of technological affordance rather than its intended use or impact. The semi-structured interviews took place inside the 3SLab, each about an hour long, and consisted of a first open part where interviewees commented freely on the process and a second part in which they replied to specific questions about the use of

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technology in the process. The questions of the second part of the interview were partly formed based on the 3SLab's long-term study of the experience of participants and visitors in the lab. However, this early empirical data was not included in the present study's findings to maintain a controlled sample.

6. Deliberative affordances of situated digital participation technology

6.1. Affording better communication through a shared immersive environment

The participants highlighted the importance of the personal presence of the different stakeholders in the lab and its role in encouraging collaborative thinking and initiative repeatedly (I1, I3, I4, I6, I7, I8). In this, they indicated the strong influence of the set-up of the room, its unique oval architecture and its immersive qualities and the physical presence of the different stakeholders. These seem to have created a positive change from the day-to-day work environment of many of them (I2, I4, I8). As one social worker explained: "we get stuck into the daily routine and forget to collaborate, each to her own, and you can't just live in one world. We must have integration between them, one informs the other" (S1). The welcoming of the transition into a specialized unique environment markedly different from the everyday is an initial indicator of the affordance of immersive technology. The immersive quality of the experience was relayed by participants in different ways, indicating the "special feeling" of being in the room (I2, I4, I7), describing how "it hugs you" (I4), making you feel "surrounded by data" (I3). A civil society activist gave an example of this effect by noting how it "makes you feel uncomfortable to be side-tracked, to look at your phone" or lose focus (S2).

The positive perception of immersion by participants aligns with growing literature on the positive relationship between immersion and agency (Edsall and Larson, 2006; Hasler et al., 2021; Kishore et al., 2016; Orenstein et al., 2015; Toland and Kilbane, 2018; Sopher et al., 2019). However, differing from studies on individual immersive experience, the quality of immersion was coupled by participants with the collective presence of the group in the room, highlighting the relevance of the lab for developing a joint strategy by "connecting all the social bodies in the city" (S5). The effect of a shared immersive space seems to both foster a motivation to participate as well as to encourage a reevaluation of the potential of collaborations and teamwork. Participants associated collaboration with the mutual engagement of collectively witnessing and analyzing data visualizations while being present together in one place, as one group, around the touch table (I3, I6, I7; See figure 2). The sense of collective witnessing of data was enhanced by the size of the projection, which also serves an immersive function, where the data "is in your face", you - literally" - can't not see [the reality]" (S4, I2).

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Figure 2: A group discussion in an immersive shared space. Session 4, 3SLab, Photograph by Arch. Bat-El Yosef Ravid

Beyond collaboration, special attention was given in the reflections to the ability to aggregate different points of view, varied subjective experiences, and information held by the different stakeholders in one place. "The 3SLab enables synchronization of knowledge. At the moment, this depends on [our] goodwill and personal conversations" (S1) said a social worker, foregrounding the potential of the lab to routinize the flow and integration of knowledge between different actors in the neighborhood. "We must connect all kinds of people that bring data: communities, NGOs, social workers" declared a community organizer (I4). Sitting around the table together and shifting the gaze from the visualized data on the screen to one another also induced a sense of commitment and answerability between participants, where they "look each other in the eyes" and are able to "put egos aside" (I6, I8 respectively).

6.2. Affording better comprehension through interactive visualization

Visualization techniques are foregrounded in literature as a critical means to make (big) data accessible and available to non-expert stakeholders, citizens, and decision-makers in processes of participatory planning (Cui et al., 2014; John et al., 2020; Lv et al., 2019). Aharon-Gutman et al. demonstrate how the visualization of inequality through 3D topographic models exposes and facilitates trends and relations unaccounted for in 2D graphs and maps (Aharon-Gutman et al., 2018). As visualization gradually takes predominance over written language (Mitchell, 1995), there is a need not only to show deliberators fixed images but to allow interaction with visualization technology as a means of expression, contemplation, and interpretation. Visualization technologies, therefore, have the potential to improve deliberative practices by "translating ideas into easily comprehensible visual representation [that] is key to effective deliberation about urban planning" (Gordon and Manosevitch, 2011: 79). To address urban

planning issues, for example, deliberators must "understand and visualize non-existent urban spaces" (Gordon and Manosevitch, 2011: 79).

Participants" responses and reflections on the theme of vision and sight, highlighting the lab's capacity to generate a "bigger picture", strongly align with literature on visualization and deliberation. Responding a simulation of the neighborhood that marks in red all the buildings where elderly citizens live, a welfare worker commented "this layer of information is highly important for us to get an idea of where we live, the actual reality of it" (S4). Given the close acquaintance of all group members with the reality of elderly citizens in Hadar, this statement foregrounds the potency of visualized data to generate a compelling "sense of reality" or a "reality check" (S4, also elaborated in I4). The experience of a shared revelation of previously invisible meaning through data visualization significantly intercepts the affordance of vision with the affordance of shared space into collective witnessing, generating an experience of "now *we* can all *see* it". Many of the participants addressed the interaction with visualization technologies in the lab as means of control in relation to the ability to zoom in and out, that is, to interactively play with scales both conceptually and tactilely through the touch table (see figure 3). "This tool can serve me as a social worker who is in the field, and there is a connection [in the lab] between the micro and the macro. I can look at a wide area and the street level" (S1), said a social worker.

Another visualization-related tension marked by participants is one located between the knowledge brought to the process by them and the data presented in the lab. Participants repeatedly connected the verification of their experiential knowledge from the field against the visualized data to their ability to act better. This appeared in two distinct ways: (1) validation of subjective knowledge that empowers the participants' position and boosts their confidence and (2) the coming into awareness of issues of concern they did not know before. "We can learn so much from what we see here, it explains things we feel all the time, but now we understand what they mean" (S4), said welfare worker. One social worker expressed a feeling of recognition, explaining "what I see in the field during the past decade and that I keep saying all the time - now I can see it in 3D – finally it has some visibility and acknowledgment" (S4). A third participant reiterates the previous two, while gesturing towards a future way of working that may combine individual experience with data: "many of the things you bring here with data we experience in the field, but [now] we can prove statistically that we are right. This strengthens us, we come with the data, and we feel it in the field" (S4). The interactive nature of data visualization technologies used in the 3SLab both facilitated comprehension of complex issues and served a means to communicate, transcribe, and validate multiple types of knowledge and integrates them into a productive deliberative communication.

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Figure 3: Interactive visualization: participants explore different scales of data on a dashboard and on the neighborhood digital tween together. Session 4, 3SLab. Image captured on cameras of the 3SLab

7. Discussion and Conclusion

We have demonstrated how situated digital technology can afford improved deliberation by addressing two main shortcomings – failures in (group) communication and comprehension of complex policy problems that deliberative processes and their participants frequently fail to address. The initial empirical findings from the 3SLab show how situated digital participation technologies can, for one, afford a shared immersive space that improves communication among participants of deliberation and, for another, enable the interactive visualization that affords better comprehension of complex urban issues as well as different experiences and subject positions. Furthermore, our findings also indicate that the two *analytically* distinct affordances, immersion in a shared space and interactive visualization, mutually reinforce each other. We, therefore, find that the 3SLab represents a paradigmatic example of how situated digital participation technology can help overcoming communicative and cognitive shortcomings that render deliberative practices difficult to operationalize.

The shared immersive experience described by participants as a "special feeling" represents a "formation of positive socio-emotional relationships among the participants" (Rosenberg, 2014: 115). The establishment of such socio-emotional relationships is precisely possible because of the *situated* digital nature of the technology which necessarily works on gathering participants in a physical space. While online digital processes have the advantage of involving more participants by being more scalable (Jankowski et al., 2019: 512), situated digital technologies create socio-emotional relationships that ease deliberative discussions.

Interactive visualization possibilities afford a better comprehension of complex urban issues by allowing participants to confirm and complement their tacit day-to-day knowledge of the

neighborhood. We find that even without mobilizing complex simulations the technologies of the 3SLab ease the analysis of urban problems by rendering urban data more easily accessible and understandable. This way, the 3SLab provides an easily usable and interactive way of enabling deliberation participants to familiarize themselves with local issues. Supporting participants with such interactive visualization tools can enable participants to make better-reasoned arguments, which are more likely to lead to other participants reconsider their views in deliberative processes (Gerber et al., 2018). However, future research ought to draw on ongoing debates regarding equality-based or equity-based paradigms of inclusion in deliberative processes to discuss how equal opportunities to shape deliberative processes through the use of technologies of interactive visualization can be ensured (Bächtiger and Beauvais, 2016).

As stated above, both affordances mutually reinforce each other to allow participants to include and relate to different types of knowledge through contrast and comparison in a collective effort. The 3Slab highlights how the different components of a participation support technology can afford different understandings of deliberation: available, visualized data affords rationalized and fact-based discussions (Cohen, 2005) while shared immersion of a group in a digital twin of an area affords the creation of emotional connections, answerability, and the facilitation of emotion-based arguments. These two affordances echo Ryfe's assertion that, "successful deliberation seems to require a form of talk that combines the act of making sense (cognition) with the act of making meaning (culture)" (2005: 63). The 3SLab affords making sense of urban issues through interactive visualization techniques, while at the same time affording the use of a shared immersive space to make a collectively shared meaning (i.e. create an emotional connection and mutual accountability). The group setting of gathering around a table echoes shared affective responses to data and feeds them back into the deliberation process. In this way, rational arguments are synthesized alongside and in tandem with storytelling, affect, and intuition. The ever-increasing use of technological tools in deliberative participatory processes also raises questions on the possibility of affordances to restrict deliberation, such as prioritizing bigdata as the basis for deliberation over other inputs and considerations. Future research ought to question such potentially adverse effects of technology on deliberative capacities.

Naturally, this study has multiple limitations. One limitation is the focus on a single case study from highly specific urban geopolitical context (Haifa's Hadar Neighborhood) and conditioned by the exemplar character of the 3SLab. As a pilot of a novel form of situated digital participation technologies, there are only a few comparisons available to date. As the 3SLab is largely unique in its design and set-up, it limits the applicability of this paper's findings. Future research ought to replicate this analytical framework in other case studies on situated digital participation technologies. Drawing from a single case study, this study is also unable to control how each of the lab's components (i.e. screens, data, room, interactive touch table) afford improvements to particular problems of deliberative processes. Future research should distinguish workings of individual technologies by controlling the affordances of individual components. These limitations notwithstanding and given the principal objectives of this study, we conclude that situated digital participation technology, as exemplified in the 3SLab, *can* to

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a large extent afford improvements to deliberative participation processes by creating positive social-emotional relationships and facilitating collective meaning-making.

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