

Chapter 8

Understanding Interactions with Conversational Agents in Collective Decision-Making: A Case Study on Community Engagement for Crisis Scenarios



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Abstract With communities facing growing climate-induced risks, participatory decision-making processes become vital in shaping adaptive and resilient futures for the built environment. Recent advancements in large-language models point to a future in which AI agents may support collective decision-making—able to facilitate deliberation, represent absent voices, and interface with built environment data. This chapter specifically investigates how voice-based conversational agents can support collective decision-making in climate-adaptation planning. Through a speculative workshop in which participants debated rebuilding or relocating a flood-affected community in assigned roles, we used a Wizard-of-Oz prototype to examine

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how a conversational agent could mediate group interactions and support deliberation on spatial and ethical concerns. Our findings highlight both the potential and the challenges of integrating AI agents as a knowledge hub and co-facilitator in public deliberation. While participants valued the agent's ability to broaden access to information and balance power dynamics, they also raised concerns around transparency, bias, and trust. The chapter contributes design insights and ethical considerations for embedding conversational agents into participatory planning processes, and discusses their potential future role as infrastructural components in climate-responsive human–building interaction.

Keywords Human-building Interaction · Conversational agents · Participatory design · Climate adaptation planning · Generative artificial intelligence · Ethical design · Collective decision-making

8.1 Introduction

As climate change intensifies the frequency and severity of natural disasters—such as floods, bushfires, and extreme weather events—communities are being forced to urgently reconsider how they inhabit and adapt their built environments. In the face of escalating environmental risk, some are forced to grapple with the complex decision of whether to rebuild in place or relocate to safer, more climate-resilient locations. To better understand and support these decisions, a growing body of research has emerged under the banner of climate migration, examining a spectrum of climate-induced mobility planning (Ferris 2024): from voluntary relocation of individuals driven by anticipatory adaptation, to sudden displacement caused by acute disasters, to planned relocation—an increasingly relevant yet under-researched strategy that aims to permanently resettle entire communities before conditions become uninhabitable (Bronen and Chapin 2013). These decisions inevitably reshape the physical and architectural fabric of communities by altering housing, infrastructure, and land use—transforming how people interact with their environment and experience space in daily life.

Central to all forms of climate-responsive planning is the need to meaningfully engage communities in the decision-making process—ensuring that adaptation strategies are inclusive, transparent, and responsive to local values and lived experiences (Lindegard 2020). Yet, achieving genuine participation is often hampered by entrenched power imbalances, uneven access to information, and the logistical complexity of coordinating diverse stakeholders, making equitable, evidence-informed decision-making difficult to sustain in practice. Traditional town-hall meetings often struggle to balance expert evidence with the diverse voices that must live with the outcome (Bryson et al. 2013). Furthermore, the complexity of climate-induced mobility strategies including the vast amount of data and information that needs to be considered makes it difficult for non-experts to equally participate in decision-making processes.

At the same time, generative artificial intelligence has matured from simple chatbots into advanced tools embedded in many features of smart cities (Luusua et al. 2023) and capable of synthesising complex data and conversing in real time (Jaber et al. 2024). Recent work shows that conversational AI can help stakeholders navigate data-heavy terrain. ChatClimate, for example, grounds GPT-4 in an assessment report by the Intergovernmental Panel on Climate Change and demonstrably improves accuracy when answering complex climate questions (Vaghefi et al. 2023). A systematic review of conversational agents in the architecture, engineering, and construction sector concludes that, while such tools **promise substantial gains in productivity and efficiency, their real-world adoption is still limited** (Saka et al. 2023). When embedded in public deliberation AI agents have the potential to support human facilitators through flood-risk projections, carbon calculations, or social equity concerns. They could also support participants in making more informed decisions on complex issues through real-time interaction with human–building data. AI agents might even speak on behalf of those who are absent or unable to participate in participatory forums, for example, non-human stakeholders or future generations affected by current decisions (Tomitsch et al. 2021, 2025; Nicenboim et al. 2024).

In this chapter, we investigate the role of advanced voice-based AI agents—also referred to as conversational agents—in participatory climate-adaptation planning. We examine how these technologies mediate human interactions with proposed changes to the built environment and influence interactions with decision-makers in scenarios of climate-responsive spatial design that necessitate both negotiations and intermediations. To do so, we conducted a simulated community engagement workshop using a speculative scenario, which required participants to debate whether to rebuild or relocate after a major flooding event in their local community. We recruited nine participants with backgrounds in urban planning, architecture, stakeholder engagement, and community-based occupations, and assigned each of them a fictional character (also known as a persona) to engage in user enactments (Odom et al. 2012; Luria et al. 2019) relevant to the speculative scenario. We also deployed and tested a Wizard of Oz prototype (Dahlbäck et al. 1993) to simulate an advanced voice-based conversational agent. Operated by a human behind the scenes, the agent appeared autonomous to participants and was represented by a voice actor who enacted different roles, strategies, and communication styles.

Based on a triangulation of video-recorded observational data and post-workshop discussions with participants, the chapter contributes insights and design requirements for a conversational AI agent intended to act as a knowledge hub and co-facilitator in participatory climate-adaptation planning. These insights relate to interaction challenges and strategies for shaping the agent’s conversational style, its influence on social dynamics, and ethical considerations in supporting collective decision-making in high-stakes contexts. In doing so, the chapter highlights the role of AI agents not only as tools for engaging communities, but as interactive, embedded elements of future built environments. We conclude by arguing that such agents can support more inclusive, responsive, and adaptive urban planning processes—making them a critical component in the broader ecosystem of Human-Building Interaction and climate action.

8.2 Conversational Agents in Collective Decision-Making

Conversational agents—systems capable of maintaining dialogue with humans—have been around for many decades (Weizenbaum 1966). Yet, conversational agents continue to be the subject of emerging research, and while initially driven by efforts from engineering and linguistics, they have recently seen increasing interest from the interaction design (Diederich et al. 2022; Zheng et al. 2022) and human-building interaction communities (Acer et al. 2022; Luusua et al. 2023; Zhu et al. 2023).

The advent of Large-Language Models (LLMs) has opened up new opportunities for conversational agents to facilitate more natural and interactive conversations through content generation and increased context-awareness (Jaber et al. 2024). However, despite impressive new voice capabilities, such as those seen in ChatGPT, conversational agents are still mostly conceived to follow a dyadic interaction paradigm, involving one user and one agent (Shavitt et al. 2021; Adlesee et al. 2023). Seymour and Rader (2024) aptly point out a dilemma here: while these technologies are promoted as pivotal to the future of work, they often neglect the importance of collaboration when humans come together to solve complex problems in the real world.

While researchers have begun to study multi-user interaction with conversational agents, their ability to enhance collaboration and decision-making in physical, spatial settings remains limited. The majority of work has looked into multi-user chatbots (Do et al. 2022; Kim et al. 2021; Wagner et al. 2022), but this does not include face-to-face settings. Research that investigated the use of multi-user conversational agents for more complex problem-solving tasks has focused on moderating teamwork situations where users typically have a shared goal (Skov et al. 2022); however, little is known about situations in which people begin with conflicting interests—requiring negotiation and consensus-building—or where existing power asymmetries shape whose contributions carry weight (Sibanda and Lues 2021). Furthermore, a core narrative within this body of work revolves around the potential for conversational agents to replace human moderators (Winkler et al. 2019), rather than considering alternative roles for those agents such as co-facilitating alongside humans or acting as co-participants.

While there is an emerging body of work on dyadic conversational agents, many efforts are tailored to focused investigations in virtual spaces rather than examining how these agents function in more dynamic social contexts (Porcheron et al. 2018). Further, as conversational agents continue to evolve, particularly with the integration of LLMs (Jaber et al. 2024), there remains a gap in understanding how interactions unfold around these agents in multi-user settings and how those agents are perceived by users.

8.3 Simulated Community Engagement Workshop: Rebuild or Relocate

Community engagement is a process of informing and collaborating with various actors to obtain feedback and input on the planning and development of public policy, legislation, and proposed infrastructure projects. This is to ensure that diverse community perspectives and needs are considered in decision-making processes (Fredericks et al. 2015, 2020; Asad et al. 2017). Community engagement is a critical element of crisis management to reduce risk and enhance resilience (Fabiyyi and Oloukoi 2013; Kamarulzaman et al. 2016; Islam et al. 2018). Workshops can be used as interactive forums to engage community representatives around actions and decision-making for disaster prevention, preparedness, response, and recovery as cascading and concurrent crisis events occur (Ryan et al. 2020).

For the purpose of this study, we designed and simulated a community engagement workshop in which participants took on assigned roles within a speculative scenario (Elsden et al. 2017). Building on prior work that demonstrates how participatory speculation can expand public imagination (Farias et al. 2022), our workshop asked participants to make a collective decision about rebuilding or relocating a community following a major flooding event. This setup simulates a critical moment of human-building interaction, where community members engage with potential futures of the built environment in response to climate-driven disruption. This section outlines the setup of this workshop, including the design of the conversational agent prototype, study design and scenario, participants, workshop activities, and data collection and analysis.

8.3.1 *Conversational Agent Prototype*

In this study, our aim was to understand how people use and interact with advanced voice-based conversational agents, rather than focusing on their technical implementation. We opted for a Wizard-of-Oz prototyping approach combined with role-playing through user enactment, both common in human-computer interaction research on conversational agents (Sadek et al. 2023).

Adopting an approach similar to Luria et al. (2019), we had a professional voice actor secretly enact our conversational agent—referred to as ‘Sage’—thereby sidestepping the latency issues often seen in technical wizard setups (e.g., real-time text-to-speech), which can disrupt immersion and participant behaviour (Simpson et al. 2022). During the workshop, the voice actor was sitting in a remote control room with their voice streamed to a Bluetooth speaker. We embedded that speaker inside a custom-made device made of laser-cut wooden and acrylic material with an LED light ring displaying blue-green ambient light patterns whenever Sage was speaking (Fig. 8.1). By providing Sage with a physical body (Ostrowski et al. 2021), we aimed both to signal its role as an addressable actor and to embed it within the



Fig. 8.1 Prototype of the conversational agent 'Sage,' represented through a custom-made device and enacted by a professional voice actor to simulate interactions in a community engagement workshop in which participants had to debate whether to rebuild or relocate their community after a major flooding event. *Source* Authors

spatial fabric of the workshop environment—hinting at how such agents might function as integrated components of future community engagement infrastructure, akin to existing smart building elements (Becerik-Gerber et al. 2022).

We intended Sage to carry out two functions: First, to provide data-based insights within the context of the speculative scenario—such as fictional cost estimates, precedent cases of community relocation, or flood risk projections—to support participants in evaluating different options; and second, to take on the role of a co-facilitator, which involved, for example, encouraging balanced contributions and mediating conflicts. For example, to encourage even contributions and ensure conversation flow, Sage could call on quieter participants by name, remind the group of shared discussion goals, or use open-ended prompts to invite multiple perspectives. These actions were enacted by the voice actor based on a combination of predefined scripts, real-time observations relayed by the research team, and a supporting flowchart that mapped facilitation goals to specific agential features.

The professional voice actor was instructed to give Sage a slightly artificial tone (similar to existing products such as Siri and Alexa). This decision was informed by previous research suggesting that deliberately robotic-sounding voices can better align people's expectations with the technology's actual capabilities (Aylett et al. 2019). ChatGPT¹ was used to generate pre-prepared answers, which the voice actor read out at appropriate moments during the workshop activity. On-the-spot answers were generated through a combination of ChatGPT and Google search, and, in some instances, improvised by the professional actor.

¹ Version GPT-4.

8.3.2 Scenario

The workshop scenario focused on a major flooding event in a fictional suburban community named Casuarina Waters. Two real-world locations in Australia informed the development of the speculative scenario: Lismore, a regional town in the Mid North Coast of New South Wales that experienced multiple flooding events between 2022 and 2025²; and Marrickville, a suburb in the inner west of Sydney located on the flood plains of a major river catchment.³ This helped ensure the context was both believable and relevant to participants (Vezzoli et al. 2017). Two potential outcome scenarios were drafted for participants to debate: rebuilding Casuarina Waters or relocating to Casuarina Heights, a less densely populated area on higher ground outside the flood zone.

8.3.3 Study Design

We recruited nine participants (five women, four men) through our university’s mailing lists and our professional and community networks. The group included professionals working in urban planning, architecture, local government, and stakeholder engagement, as well as community members such as retail workers and local artists, bringing lived perspectives from flood-affected communities.

Six researchers supported the workshop. Three researchers (one woman, two men) role-played as community engagement facilitators. Two researchers assisted the voice actor: one of them, sitting together with the voice actor in the remote control room, guiding the actor through the conversation flow map, providing the pre-prepared scripts to read out and generating on-the-spot answers. The other researcher acting as an assistant, sat in the workshop room to remote-control the light patterns when Sage spoke and relay contextual information—such as participants’ persona names—back to the remote control room via a text chat setup. Additionally, a ceiling-mounted camera captured a video stream of the workshop room (Fig. 8.5), enabling Sage to act context-aware, for example, by referring to a participant using their persona name during conversations. Participants were told the scenario was hypothetical and that some researchers would be “in character” as facilitators, but they were not informed about Sage’s Wizard-of-Oz enactments until a full debrief after the community engagement workshop.

² ABC News. (2025, May). SES says lessons learnt in 2022 Lismore floods helping Mid North Coast torrential rainfall response. <https://www.abc.net.au/news/2025-05-22/nsw-mid-north-coast-hunter-floods-ses-lismore-2022/105322370>.

³ The Guardian. (2021, April). Tram Vale: the flood-stricken development that should have taught Sydney a lesson, but didn’t. <https://www.theguardian.com/australia-news/2021/apr/03/tram-vale-the-flood-stricken-development-that-should-have-taught-sydney-a-lesson-but-didnt>.

Upon arrival, participants were welcomed to the workshop by the three researchers who would later assume the roles of community-engagement facilitators. Participants were introduced to the high-level workshop goals without mentioning Sage, which was only introduced in the second part of the workshop. Subsequently, each participant was assigned to a fictional character and was asked to enact this role until the end of the workshop. To do so, each participant received background information about their fictional character in the form of a persona card (Salminen et al. 2022) including their role within the community (e.g., local artist, mayor), backstory (i.e., engagement within the community during and/or prior to the crisis event), likes and frustrations, and motivations. Each persona was drafted in a way to give workshop participants some subtle hints about their character’s stance and the community that they were representing, however, without forcing participants to take on a predetermined opinion on the potential outcome (rebuilding versus relocating the community). Participants also selected a photograph for their persona from a collection of provided portraits, gender, and name (a list mapping persona names to roles can be found in Table 8.1). This approach was chosen to allow participants to better empathise with their fictional character and to feel more comfortable in the role-playing task. To further help them connect with their character, the professional voice actor (who also acted as the voice of Sage), facilitated a two-minute meditation exercise, inviting participants to consider how their character may have started their day, arrived at the workshop, and so on.

We started the role-playing exercise by welcoming participants (now acting as community representatives) and playing a fictional TV news video covering the

Table 8.1 Overview of participant personas, their assigned roles, and the relative speaking time (in %) during the two workshop activities (Activity 1: without Sage, Activity 2: with Sage)

Persona	Role	Activity 1 (%)	Activity 2 (%)
Jenna	Mayor	16.08	11.39
Steve	President of “save casuarina waters”	2.22	1.98
John	Water engineer	7.11	2.84
Ian	City planner	12.07	3.84
George	Environmental activist	3.68	2.18
Peter	Local resident	3.34	7.51
Wendy	Cafe owner	0.31	0.62
Tim	Emergency services coordinator	0	3.65
Jem	Local artist	8.92	4.39
Jackie*	Community engagement facilitator	17.11	14.74
Sam*	Community engagement facilitator	13.50	0
Ale*	Community engagement facilitator	15.64	1.40
Sage*	Conversational Agent	–	46.51

The data illustrates shifts in participation and the impact of the conversational agent on group dynamics

impact of the flooding event on Casuarina Waters. This was followed with a 15-min icebreaker exercise. Participants were given a set of cards with predefined keywords to develop a project charter, outlining their intentions and approaches for working together respectfully and collaboratively. This exercise fostered engagement and provided insights into the crisis at Casuarina Waters, guiding how they would address the issues collectively.

Activity 1

For the first workshop activity, participants were asked to consider the advantages and disadvantages of rebuilding versus relocating the Casuarina Waters community while acting out their assigned roles. This activity was moderated by the three researchers acting as community engagement facilitators.

The participants arranged themselves around a large table on which we placed an A2-sized paper-based prototype of an interactive tabletop application (Fig. 8.5). The prototype design was inspired by the digital participatory urban planning platform *Social Pinpoint*,⁴ which allows users to add pins on an interactive map to indicate areas of concern and suggest improvements (Carden et al. 2016). Our paper-based prototype ‘displayed’ maps of Casuarina Waters and Casuarina Heights, marked with relevant locations such as flooded areas, residential zones, and industrial regions. To simulate the platform’s functionality, participants were asked to use yellow and blue sticky notes to ‘pin’ benefits and disadvantages for their community when considering rebuilding Casuarina Waters in its current location versus relocating to Casuarina Heights. Participants could request the facilitators to ‘swap’ the displayed map between the two locations as needed. While adding their pins to the map, participants were encouraged to talk to each other and discuss their stances. The duration of this activity was 23 min (with 18 min of active speaking detected).

Activity 2

After a 15-min break, we began the second part of the workshop in which we introduced Sage for the first time. Participants were not aware that a voice actor played the role of Sage to provide the impression that Sage was a fully functional LLM-powered and context-aware conversational agent. Participants were asked to continue their discussions about whether to rebuild or relocate the Casuarina Waters community, while working towards a consensus. The three workshop facilitators continued to moderate the session, with Sage being introduced as a co-facilitator to provide any information that participants might need to reach a decision.

Sage was placed on the table next to the interactive tabletop prototype and, upon request from one of the facilitators, introduced itself and began the session with a high-level summary of the first workshop activity. Afterwards, participants were allowed to ask Sage questions at any point. To guide participants in interacting with Sage, we handed out prompt cards with relevant example questions. For instance, a participant representing a water engineer received a prompt to ask about the potential

⁴ <https://www.socialpinpoint.com>

for more sustainable water infrastructure in the event of relocation. However, participants also asked Sage their own questions. Additionally, we used behaviour cards as a mechanism to drive responses and reactions with the aim to simulate different interaction dynamics with cues such as “*Pound table and disagree.*” The duration of the second activity was approximately 40 min (with 33 min active speaking detected).

After the workshop activities, we asked participants to step out of the characters they had played and conducted a 35-min group discussion about the activities, including their experience of interacting with Sage. One of the researchers—who had earlier portrayed a community-engagement facilitator—led the discussion based on a list of pre-prepared questions, which included “Can you recall any moment that you found the AI agent’s intervention was useful (or you wanted the agent to step in?)”, “Can you recall any moment you wished you could turn off the agent?”, “How much do you trust what the agent told you?”, “How did the incorporation of the AI agent impact the discussions and engagement in the workshop?”, and “In what ways did AI agent enhance engagement, collaboration, and decision-making among participants during the workshop?” The researcher actively encouraged all participants to contribute answers, sometimes specifically addressing participants, to ensure everyone contributed to the discussion.

8.3.4 Data Collection and Analysis

We collected data by video and audio recording both workshop activities and the subsequent group discussion. Transcription was done automatically using the qualitative data analysis tool *Dovetail*.⁵ One researcher then manually reviewed the transcript to correct any errors and to label the different speakers. Based on the transcript, we did a descriptive analysis that included calculating the total speaking time for each participant (Table 8.1) and creating box plots to visualise the distribution of speaking events over time (Fig. 8.3).

For qualitative data analysis, we used *Dovetail* to conduct a thematic analysis of both the recordings and transcripts from the workshop activities and the post-workshop group discussion. This cross-analysis method allowed for a more nuanced interpretation of specific observations. We then followed a deductive thematic analysis approach (Braun and Clarke 2006). After one of the researchers developed an initial set of codes and themes, we convened a 1-h meeting with three additional research team members, all of whom are authors of this chapter and were involved in conducting the workshop. We finally incorporated a conversational analysis approach (Sacks et al. 1978) within this framework to further examine the interactional dynamics and communication patterns (e.g., turn-taking) that emerged during the discussions (Grønkvær et al. 2011).

⁵ <https://dovetail.com>

8.4 Results

This section first presents an overview of the group interactions in workshop activity 1 (without Sage) compared to workshop activity 2 (with Sage). We specifically look into two distinct phases of activity 2, where Sage first functions as a knowledge hub and then transitions into a facilitator role, examining how this shaped participant interactions.

8.4.1 Overview

The beginning of workshop activity 1 was dominated by the turn-taking in conversations between the workshop facilitators (visualised in Fig. 8.3, top), as they were explaining the mapping activity to participants and setting the stage for the discussion. After a few minutes, this naturally transitioned into a more participant-driven dialogue. Participants in their role of different representatives began to argue their case, thereby often referring to the map to support their argument (Fig. 8.5, left). At this stage, participants would also begin to form alliances with those who shared a similar agenda. Facilitators would only occasionally step in, for example, when specific factual questions about the speculative scenario arose (that, if left unaddressed, could have led to a deadlock in the discussion) or to redirect attention to aspects brought up earlier.

Sage as Knowledge Hub

During the first half of the workshop activity with Sage, participants primarily engaged in a structured exchange with Sage, where they took turns asking questions (Fig. 8.3, bottom). Questions were either based on the prompt cards or formulated by the participants themselves, resulting in single question/answer adjacency pairs. This interaction would often be closed by participants with a post-expansion, typically saying, “Thank you, Sage.” Rather than continuing with a response or related follow-up question to the answer provided by Sage, the interaction would end at this point or change topic. Change in topic would either be triggered by the same participant asking a follow-up (but not necessarily related) question or a different participant asking a new question. After an interaction was complete, there was often a brief pause in conversation, and occasionally Jackie, one of the Community Engagement Managers, would need to open up the conversation again.

Sage as Facilitator

In the second half of the workshop activity with Sage, the conversation flow changed significantly. This change was initiated by Sage, who after receiving yet another question from one of the workshop participants, responded:

I am so sorry. I did not hear the question. I just wanted to take a moment to say that I feel like I have been doing a lot of talking. You may be getting tired of my voice. It may be time

for you to ask questions of each other and discuss as we only have now approximately 20 minutes to go.

Here, the voice actor of Sage—presumably only pretending to not have understood the question—initially accounted for not answering. However, instead of waiting for conversational repair to happen, they continued speaking in order to proactively redirect the discussion by facilitating a shift in group interactions. After this prompt, which was further followed-up on by the Community Engagement Facilitator Jackie, the conversation began to resemble more the structure of the first workshop activity (Fig. 8.3). While Sage was still involved in the conversation, Sage’s responses to knowledge-related questions were shorter and Sage more often took over the role of a facilitator, opening the discussion by asking participants for their opinions.

The fragment in Fig. 8.4 demonstrates such a conversation with turn-taking in the interaction between participants with each other and Sage. This interaction was initiated by Tim (one of the more reserved participants) after receiving a card that prompted him to suggest to the group to consult Sage for advice. This preceded a longer exchange in which several participants stating their stances, leading to an increasingly heated debate with two participants expressing their ‘strong’ disagreement. Despite Tim addressing the group (i.e. “Can *we* ask Sage [...]”), his message was implicitly directed towards Sage with his voice becoming notably clearer and slower when uttering ‘Sage’. Noteworthy, after a short pause and just before Sage could respond, Jenna took over the facilitation by trying to clarify Tim’s intention of seeking advice from Sage. Over the course of the conversation, Sage’s strategy then aimed to narrow down the broader concerns by Tim, and while expressing affirmation for the validity of his concerns (i.e. “Communities are very important [...]”) trying to open up the discussion by seeking advice from the whole group (i.e. “Does anyone at the table have an idea of how to do this?”).

8.4.2 *Conversational Content*

The conversational content was shaped by the flowchart and scripts we crafted to guide the voice actor of Sage, as well as the prompt and behaviour cards. In the post-workshop discussion, participants stated that Sage’s high-level summary of the first workshop activity as well as some of the responses to participants’ questions from the prompt cards were too “long winded” (George) and “exhaustive” (Steve). One of the participants, role-playing Ian, stated that “the facts just went over [her] head and [that she] couldn’t stay engaged.” In regards to Sage outlining advantages and disadvantages or key aspects to consider, she felt reminded of consultant speech “saying all the right words like innovation, transparency, consultation, [...]” Instead, she would have preferred “if the AI was used to generate ideas rather than give facts.”

Meanwhile, other participants appreciated Sage’s ability to “check data,” as also evidenced by their numerous questions regarding time, cost, and likelihood. They,

however, expected concise and exact answers (i.e. numbers) to those kinds of questions, which were at times challenging to provide due to the speculative nature of the scenario. A notably effective instance of fact-checking occurred when Jenna asked Sage: “It’s the mayor. Can you please give me an example of a town that has relocated successfully in Australia and what made it successful?” The answer provided by Sage (with the help of Google and ChatGPT) was considered “helpful” and “to the point.” Interestingly, Sage not being able to instantly answer the question, but instead explaining the necessity to retrieve information first (to buy time for the assisting researcher to find the information), and later after the conversation had already progressed to another topic coming back to this question, did not have a negative impact on this assessment.

8.4.3 Group Interactions

To a certain extent, Sage was able to balance participation among representatives. However, some of the more assertive participants, particularly Jenna, who acted in the role of the mayor, continued to dominate the discussion, maintaining a noticeably higher speaking time compared to others (Fig. 8.2). One explanation for this, could be that Sage in its role of facilitator only twice called out participants directly, while otherwise attempting to address the whole group which then allowed dominant participants to jump in again.

In the post-workshop discussion, two participants explicitly expressed support for a conversational agent to “[balance] the dynamics, [...] take the power out of



Fig. 8.2 Participants and facilitators during workshop activity 1, with their personas depicted by the overlaid labels. *Note* Community engagement facilitators Sam and Ale are not present in the image, and the conversational agent Sage had not been introduced at this stage. *Source* Authors

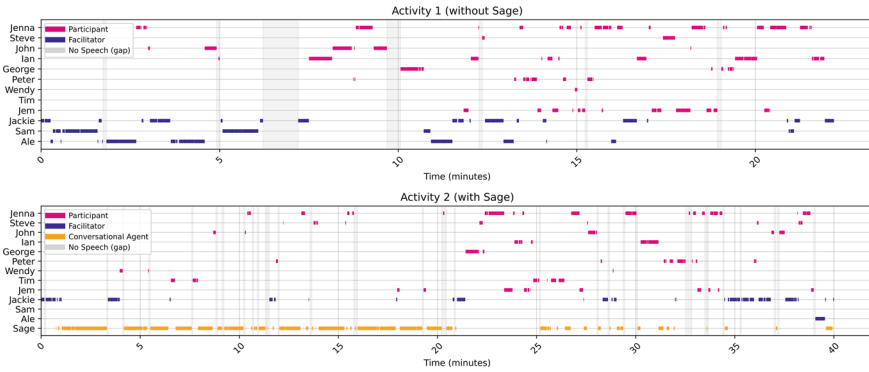


Fig. 8.3 Visualisation of detected speaking events in workshop activity 1 (top, without Sage) and workshop activity 2 (bottom, with Sage) over time; the horizontal lines indicate speaking intervals for participants (pink), human facilitators (blue), and conversational agent (yellow); gaps with no speech lasting longer than 3 s are marked in gray. There were two notably longer gaps (around minute 6 and 9) in workshop activity 1, with no clear speaker detected as participants were ‘adding pins’ to the paper-based prototype of the interactive tabletop application. *Source* Authors

the room” (Ian) and “reduce some tension” (Steve). They referred to Jenna as being the “noisy squeaky wheel which we’ve all seen in these sorts of real-life scenarios,” reflecting on their personal experience in community engagement and planning. The participant role-playing Jenna later stated that she personally noted a shift in power dynamics with Sage’s involvement, expressing frustration: “I want to control the dynamics, right? I’m like, what is that thing? I can’t control it.” This is noteworthy as our observations provide evidence that Jenna was still the most active among all participants. Further, Jenna regularly leveraged Sage, for example, to reaffirm others of her argument, “I don’t think we are guinea pigs for relocating. *As Sage said*, they’ve already relocated a town—so there’s a history of that” or in an attempt to co-facilitate with Sage, “hey, hey, hey, hey, *she [Sage] said* speak respectfully. So let’s just make the conversation calm.”

Participants would regularly interrupt each other, resulting in overlapping speech, especially at times when the debate became more heated. Interestingly, whenever Sage started to speak, the group paused their discussion, became silent and paid attention to Sage talking. In the post-study discussion, participants noted that particularly in the first phase when Sage was answering knowledge questions, “the AI became the centre of everything” (John). The participant role-playing Steve noted that “the urge to move [among representatives]” suddenly disappeared and that he felt that “everyone was trapped around [Sage].” This aligns with our own observation (Fig. 8.5, right): following Sage’s introduction, participants predominantly remained seated as well as shifted their focus away from the interactive tabletop prototype they had previously engaged with.

Some attested this perceived change in group dynamics to the physical form factor of Sage. For example, the participant role-playing Ian noted that “[she] was watching [Sage] when it was speaking like it was a face [and] would feel rude to

Tim: Well, I don't (.) I don't fully understand what's going on here. aehm (???) lost. Can we ask aehm (.) Sage some advice? (.)

Jenna: What would you like to ask Sage?

Tim: Just about, (.) (laughs) I'm lost here. (2.0)

Sage: I am so sorry, you are feeling lost. (some laughters) I think there might be some skepticism in the room and it is important for us to have clear and honest conversation. So let us try to address any underlying concerns. What are you feeling hesitant about specifically?

Tim: Everything, Sage (some laughters)

Sage: Oh Tim, everything is a bit too wide for me to research.

Sage: Is there something specific I can advise you on, Tim?

Tim: Just about the re-planning (.) aehm If we are moving to Casuarina Heights, like we were talking about maybe we might have to remap the area because there's not much greenery, that kind of stuff, the (.)

George: [feasibility]

Tim: [feasibility of the time].

Sage: Yes, these things do take time. What are you most afraid of Tim?

Tim: I'm just making sure that, you know, there is still a sense of community aehm that, you know, aehm there's a place. aehm aehm yeah, you know, communities can still be around that kind of stuff. (1.5)

Sage: Communities are very important and I think this group of people understand this. So it is up to us to make sure we facilitate these communities, spaces and areas. Does anyone at the table have an idea of how to do this? (2.0)

Jenna: I do have an idea around more the future terms, the Art Center is that something that we could build sort of initially? Because I think the art is a really important way to get people umh to express what they're feeling and how they're actually coping with the situation. So maybe that's the way to actually help shift into this new area, but it doesn't address the [immediate]

Jem: [Art making] doesn't (.) so art makers aren't social services people. We're not counselors don't make us do the like trauma response (.) triage work.

Peter: I have a [question].

Sage: [Yes], I agree. I think we will definitely have some professional social workers in the town. Thank you for that suggestion.

Steve: Where are they gonna live? (.)

Peter: Ohm Sage just wondering if we, we have a buyback scheme for the existing residents of this new community. Is that a compulsory acquisition or is it a stage withdrawal on a voluntary basis? And what if so what kind of impact does that have on the relocation strategy? I'm interested from the point of view of infrastructure planning.

Fig. 8.4 Change in topic initiated by Tim (Emergency Services Coordinator) who asks Sage for advice. During the course of the conversation, Sage then facilitates the discussion, encouraging group participation. *Source* Authors

be like looking around.” Speculating about the role of Sage’s embodiment, some suggested a more humanoid appearance while others disagreed. For example, Steve, mentioned that similar to Ian, “he couldn’t look away” but was therefore wondering if Sage should be “invisible [and] just a sound coming from under the table.” Others were less concerned about Sage’s physical appearance or placement but more the conversational agent’s social presence and interactions. For example, Jenna stated: “You’d have to introduce [Sage] at the beginning, so it just becomes another member



Fig. 8.5 Ceiling camera capturing the two workshop activities, without Sage (left) and with Sage (right). Once Sage (circled in yellow) was introduced, physical movement and engagement with the interactive tabletop prototype reduced with participants mostly remaining seated. *Source* Authors

of the team. So it has a persona in that sense, [and] you know, what is its role and function.”

8.4.4 Lack of Trust in AI

During the post-workshop discussion, participants unanimously expressed a lack of trust in Sage which was caused by two factors: the system’s opacity and a perceived bias in its decision-making process. One of the participants, Peter, stated that he “questioned every answer [by Sage].” Another participant, Jem, added that “thinking about where these facts are coming from [...] was always in the back of [her] mind,” indicating a lack of transparency in regards to the origin of the data when Sage was providing additional information (e.g., regarding the historic example of relocating a town). Interestingly, while transparency was a major concern in terms of trust, none of the participants brought up in the post-workshop discussion that Sage occasionally was not able to immediately respond to participants’ factual questions. This may have been due to the fact that the voice actor always instantly highlighted Sage’s inability to answer (e.g., no data available, connection issues).

More than half of the participants expressed that they believed Sage to have a bias, leaning towards relocation of the community. Participant John stated that “[he] felt that the AI was guiding us towards one option,” a sentiment that was echoed by others in the group through nods of agreement. John further stated that “the focus was always on the benefits of the relocation rather than is it possible to stay; so the ‘Should-I-stay-or-should-I-go’ scenario seemed to be more like: ‘You’re going,’” which made him speculate that “you [the research team] typed in the benefits for the relocation.” This was an unexpected finding as we did not design the conversational flow and responses to represent any opinion towards one or the other option. Indeed, the opening dialogue began by summarising the benefits and disadvantages for both rebuilding and relocation. Furthermore, the voice actor role-playing Sage was briefed to not take on any side during the improvised dialogues which they also occasionally expressed to the group by reminding them that “I [Sage] don’t have an opinion.”

The combination of perceived bias and lack of transparency was also reflected in participants' broader scepticism towards AI in community engagement for the built environment. This sentiment culminated in one participant expressing concerns about involving AI in high-stakes decision-making: "If you're talking about real things and real people and real decisions that impact people, in my opinion, it is way too risky because you're gonna impact someone's life based on some AI facilitating at the right point."

8.5 Discussion

The findings from Sage acting as both knowledge hub and co-facilitator reveal a number of insights and design considerations for conversational agents intended to support multi-user deliberations within built environment contexts. In this section, we reflect on the challenges and strategies for shaping an agent's conversational style, its influence on the social dynamics of group interactions, and ethical concerns that arise when such agents mediate collective decision-making. We also consider how these dynamics unfold in relation to spatial decision-making, climate-responsive planning, and the participatory shaping of future built environments.

8.5.1 *Interaction Challenges and Strategies*

Previous work has examined how the limited capabilities of existing conversational agents lead to interactional issues that have to be accounted for by the user (Porcheron et al. 2018), particularly when it comes to more complex task scenarios (Jaber et al. 2024). Our findings add to this by pointing out new challenges potentially emerging with advanced conversational agents and how they could be overcome in multi-user face-to-face settings.

Avoiding Long-Form Content

As we wanted to simulate interaction with an advanced voice-based conversational agent (that, if implemented would be powered by a LLM), we deliberately decided to use ChatGPT for generating some of the pre-prepared responses, which Sage mostly relied on during the initial phase of workshop activity 2 (when acting as a knowledge hub). Our findings reveal that the length of these responses led to lower engagement, also evidenced by participants often not following up on responses from Sage. While recent studies that investigated voice interactions for guiding users through step-by-step tasks have found that information overload can be an issue in instructional contexts (Hwang et al. 2023), we anticipated that long-form content would pose fewer challenges in our round-table setting. This expectation was based on the premise that workshop discussions often include extended monologues and that people are becoming more accustomed to consuming long-form text-to-speech

content, such as news articles or audiobooks (Cambre et al. 2020). Our findings, however, demonstrate that in a participatory workshop setting AI-generated content should be kept shorter with not too many different information pieces included in a single response by a voice-based AI agent.

Conversational Alignment

The robotic voice may have amplified the issue of reducing engagement and causing information overload. However, our findings also indicate that the communication style in LLM-generated content, known to be violating the cooperative principle of conversation (Ningsih and Rohmah 2024) and by our participants referred to as “consultant speech,” is even more challenging to interact with via a voice-only interface. When summarising responses from participants in a group discussion, such as during Sage’s opening dialogue, it is important to consider conversational alignment. This includes techniques like lexical alignment (Wang et al. 2024) and recipient design (An et al. 2021), which help the agent more closely mirror participants’ language and communication style. Without this alignment, the summarised content may come across as abstract or disconnected, which can make it difficult for participants to recognise the input as their own.

Context-Aware Response Timing

Sage was not always able to respond immediately and sometimes responded to questions later in the conversation. Yet, this did not negatively influence the flow of the overall discussion nor did it lead to distrust towards the agent. This indicates opportunities for voice-based conversational agents in group discussions: instead of providing too much information at once, or in order to better balance topics throughout a conversation, the conversational agent could strategically introduce information or respond to questions at contextually appropriate moments. Different from voice-based interaction in more traditional settings following the request-response paradigm for simple task execution (Luger and Sellen 2016), AI-supported discussions seem to repair more easily, potentially allowing for asynchronous interactions. This also opens up the possibility of situating conversational agents as infrastructural components within the built environment (Becerik-Gerber et al. 2022)—able to observe, interpret, and engage with participatory processes as they unfold over time, rather than only at discrete moments.

8.5.2 Social Interaction Dynamics

While the conversational dialogue and style—when Sage acted in the role of a knowledge hub—certainly contributed to a disengagement of participants with each other and their environment, the group never fully recovered from this even when Sage transitioned into the role of facilitator. In the following, we discuss factors that influenced these social interaction dynamics and present considerations on how to mitigate these issues.

Strategies to Balance Participation

While Sage in two instances addressed participants directly to encourage them to speak, as a facilitator, they more commonly posed general, open-ended questions to the group. While effectively avoiding issues of calling out participants directly (Kim et al. 2020; Do et al. 2022), we also witnessed how this approach would lead dominant participants (re: Jenna) to take over again, sometimes reinforcing existing hierarchies. This may even explain why participants had the perception that Sage was biased—leaning towards the decision to relocate—simply, because the conversation with Sage would focus more frequently around this topic. While topic management has previously been investigated to improve dialogue coherence (Macias-Galindo et al. 2012) and personalise topics to enhance user engagement (Glas and Pelachaud 2018), there is a need to explore how topic management techniques can be adapted to effectively mitigate dominance in group discussions, ensuring that the discussion remains balanced while not explicitly calling out participants. In climate-responsive planning where diverse expertise and positionalities intersect, conversational agents could be calibrated to gently steer discussion toward neglected themes, thereby making built environment planning more inclusive and polyvocal.

Impact of Situated Presence on Group Dynamics

The physical form factor of Sage has frequently been brought up in the post-workshop discussion. Other than in an online group chat (Kim et al. 2021), using a conversational agent in an in-person discussion inherently led to imbalances in communicative abilities, with human participants being able to additionally communicate non-verbally by using gestures, maintaining eye contact, and interpreting body language. While in previous research (Kim et al. 2020), participants perceived the chatbot as a group member (despite their facilitating role), this did not occur in our case, also evidenced by participants expressing ambiguity about Sage’s role and the way participants interacted differently with Sage compared to the rest of the group (i.e., pausing their discussion whenever Sage spoke; using post-expansions in conversations with Sage).

While prior research exploring the role of social embodiment in voice user interfaces may suggest that a more human-like embodiment for Sage could have fostered more reciprocal interactions within the group (Ostrowski et al. 2021), it is crucial to consider the specific context of our study. Unlike the casual, socially oriented domestic environments our study was situated in a professional environment with a focus on collective decision-making. Our participants expressed indifference about the ideal embodiment for Sage, whether invisible, architecturally integrated, device-like or humanoid. This insight, along with the broader design considerations, provides a foundation for more targeted investigations into which forms of embodiment are most suitable. Additionally, participants’ feeling of being trapped around Sage—positioned centrally in the room—suggests that a conversational agent’s placement in physical space reconfigures participant behavior and engagement within the environment. In participatory shaping the future built environment, this invites a broader

reflection: How might future agents be designed as part of the spatial infrastructure itself—distributed across walls, furniture, or architectural surfaces—rather than centralized as a singular object?

Conversational Agent Role and Expertise

Our findings indicate that Sage transitioning from being used by participants as a knowledge hub to the role of a facilitator may have caused difficulties for participants to grasp the conversational agent’s social presence. This was evidenced by some participants questioning the role of Sage and proposing for Sage to be introduced to participants at the beginning. This might stem from the nature of community engagement workshops, where distinct roles, such as topic experts and moderators, are typically filled by different individuals. Moreover, previous research on the social presence for robots and conversational agents (Luria et al. 2019) indicates that while people generally accept agents transitioning their social presence across different bodies and environments, some expressed concerns when agents show non-human behaviour for tasks that are perceived as requiring a high level of expertise.

8.5.3 Ethical Use of Conversational Agents in Collective Decision-Making

Previous work has highlighted trustworthiness related to privacy, security and transparency as an important concern for users when interacting with conversational agents as personal assistants (Clark et al. 2019). While transparency has been also identified in our study, our findings additionally point out worries about advanced facilitation capabilities of LLM-powered conversational agents in collective high-stake decision-making processes.

Transparency in Information-Seeking

With the surge in popularity of large language models, information transparency has become one of the key research concerns in ethical and responsible use of AI (Tsai et al. 2024). Ensuring transparency by including reference source information is essential for users to build and maintain trust in these tools (Jung et al. 2024). While this has been extensively discussed in the context of scientific integrity, academic research, and education (Yusuf et al. 2024), our study reveals that system opacity—specifically, the failure to disclose sources of information—impedes trust. While many chatbots now provide source citations as clickable links into their responses, it remains an interactional challenge yet to be solved how best to integrate such sources in voice responses. Our findings indicate that shorter responses are preferred. Future research should therefore investigate how voice-based AI can disclose its sources through in a lightweight manner, for example through verbal cues when requested or complementary visual hints on an integrated display.

Co-Facilitating Along Humans and Limiting Capabilities

Despite the speculative scenario, we were able to generate critical discourse of what could happen if even more advanced conversational agents were to be deployed in real-world planning contexts. Provoked by the perception of having interacted with a biased conversational agent, participants expressed concerns in the post-workshop discussion about the facilitating role of AI in collective decision-making processes. Even though hypothetical at this point, continuing the speculation of one of our participants who expressed concerns about “some AI facilitating at the right point,” it would be conceivable that an advanced AI agent—combining goal-oriented dialogue systems, natural language processing, and conversational strategies—could be used to subtly steer a group towards predetermined outcomes. This concern is not merely theoretical; empirical evidence indicates that AI-driven chatbots and generative systems have already been deployed in political contexts to influence public opinion and voter behaviour. For instance, AI-generated content has been utilised in recent election cycles by various actors to amplify disinformation, impersonate political figures, and sway public discourse (Ferrara 2017; Bontridder and Poulet 2021). These developments corroborate the necessity for ethical scrutiny when deploying conversational agents in contexts involving high-stakes collective decision-making, particularly concerning the built environment, public resources, or democratic processes.

Thus, a conversational agent co-facilitating alongside humans, rather than replacing them, is not merely a matter of enhancing engagement and user experience. At its core, it raises important ethical considerations, including the possibility to limit the conversational agent’s involvement to specific, predefined tasks, as highlighted by our participants. This becomes even more crucial if such agents are imagined as infrastructural participants in climate-responsive urban systems—where their ongoing presence could influence planning outcomes, shape community engagement patterns, and mediate between conflicting socio-technical and spatial imaginaries over time (Chateau et al. 2021).

8.6 Conclusion

This chapter examined how a generative voice assistant can enrich and stabilise stakeholder conversations in multi-user and face-to-face settings. Through a simulated climate-adaptation planning workshop, we observed the agent widening the pool of accessible information, balancing engagement and turn-taking, and prompting participants to articulate positions that might otherwise remain unspoken. Participants valued the agent’s ability to access and provide facts. In terms of group dynamics, the agent was described as able to “take the power out of the room” (in our scenario, referring to the mayor persona), suggesting its potential to support more equitable collaboration and decision-making processes.

However, we also identified a set of ethical concerns—including data transparency, algorithmic bias, and the preservation of community agency—that must be addressed if conversational agents are to take a responsible role in collective decisions about the built environment. More than half of the participants reported feeling coerced by the agent into making a decision—a perception likely amplified by a lack of trust and perceived empathy. This is especially problematic in high-stakes scenarios, such as shaping the future of the built environment. We argue that managing these risks requires clarity about the agent’s role, transparency regarding the information it shares, and greater attention to how dialogue is structured and moderated.

While the scenario we presented was framed around climate-induced flooding, the decision matrix—*upgrade, rebuild, or relocate*—applies more broadly to built environment projects such as urban retrofits, office precinct upgrades, stadium developments, or new development proposals. Looking forward, research in human-building interaction could explore how conversational agents might evolve from one-off planning tools into ongoing infrastructural participants in the built environment—facilitating dialogue not only during planning, but throughout the life of the building (Brand 1997). For example, smart-home assistants have been shown to nudge energy-saving behaviour (He et al. 2022), and ontology-driven chatbots can now interpret natural-language queries in building operations (Suhas et al. 2024). Yet, these applications are largely transactional, designed for one-on-one interactions. By contrast, Sage was conceived as a polyadic facilitator, weaving together multiple perspectives and data streams in support of collective decision-making in climate-adaptive design.

Still, this focus on engaging the public in speculating on urban planning and human-building interaction futures (Economidou 2023) introduces a limitation: it intervenes relatively late in the decision-making pipeline after priorities, frameworks, and values have already been shaped by governance systems and institutional logics. As (Metzger and Hillier 2024) argue, achieving meaningful change requires us to “go upstream:” to question and transform the underlying structures that define whose voices (human and non-human) are legitimised in the first place. Without this broader shift, even well-designed participatory technologies may struggle to effect substantive change.

Relatedly, it is important to acknowledge the risk of co-optation. Corporate or government actors may not only use AI agents for disinformation or agenda-setting; they may also deploy such technologies in more benign but equally problematic ways. One such risk is the orchestration of “engagement theatre” where community involvement appears technologically progressive but is, in fact, tokenistic (Monno and Khakee 2012; Mattern 2020; Kamols et al. 2021; Dobson and Parker 2023). Here, conversational agents may serve more to simulate listening than to enable genuine public influence, masking pre-determined outcomes under the guise of participation. This reflects the enduring ‘DAD’ principle: *Decide, Announce, Defend*.

Finally, we believe further research is needed to strengthen not only the conversational qualities of AI agents, but also their rhetorical, strategic, and relational capabilities, which are essential for deliberating and scaffolding the discourse needed to inform desirable urban futures. To do so, we can draw on perspectives from dialectics

and intermediation that have long been central to participatory design. As (Frauenberger et al. 2018) argue, effective participation often arises through tension and contradiction—not despite it. Intermediaries will continue to play a vital role not just in mediating between institutional power and community voice but also in the human-building interactions with AI agents (Teli et al. 2022; McQueenie et al. 2024). Future research could thus explore how AI agents, acting as digital intermediaries, might support more open-ended, agonistic, and affective forms of dialogue about the future of our built environments.

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