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AI-Supported Participatory Workshops: Middle-Out Engagement for Crisis Events

Martin Tomitsch [1], Joel Fredericks [2], Marius Hoggenmüller [2], Alexandra Crosby [3], Adrian Wong [2], Xinyan Yu [2], and Weidong Huang [1]

[1] Transdisciplinary School, University of Technology Sydney, Australia
[2] School of Architecture, Design and Planning, The University of Sydney, Australia
[3] Faculty of Design, Architecture and Building, University of Technology Sydney, Australia

Correspondence: Martin Tomitsch (martin.tomitsch@uts.edu.au)

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Abstract

Considering the lived experience of communities is key when making decisions in complex scenarios, such as preparing for and responding to crisis events. The article reports on three participatory workshops, which assigned community representative roles to workshop participants. Using role-playing as a method, participants were given the task of collaborating on making a decision relating to a speculative crisis scenario. Across the workshops, we collected data about simulating a middle-out engagement approach and the role of artificial intelligence (AI) in enhancing collaboration, supporting decision-making, and representing non-human actors. The article makes three contributions to participatory planning and design in the context of the UN Sustainable Development Goals. First, it presents insights about the use of AI in enhancing collaboration and decision-making in crisis event situations. Second, it discusses approaches for bringing more-than-human considerations into participatory planning and design. Third, it reflects on the value of role-playing as a way to simulate a middle-out engagement process, whereby actors from the top and the bottom collaborate towards making informed decisions in complex scenarios. Drawing on the findings from the workshops, the article critically reflects on challenges and risks associated with using AI in participatory workshops and collaborative decision-making.

Keywords

artificial intelligence; community engagement; conversational agents; middle-out engagement; non-human personas; participatory design; participatory planning

1. Introduction

Community engagement has long been used as a way to inform decision-making (Jenkins & Henley, 2014). Often these decision-making processes are led by government authorities or organisations acting on behalf of the government. In practice, community engagement initiatives have faced criticism for being perceived as tokenistic and merely a checkbox activity (Levenda et al., 2020; Monno & Khakee, 2012; Parker & Murray, 2012). Traditionally, these kinds of engagement activities are typically linked to large infrastructure projects to inform planning and design decisions. With awareness of community engagement and the importance of establishing and maintaining a "social license" increasing (Dare et al., 2014), the means for engaging communities and considering their voices have become more sophisticated. These advancements are further accelerated by technological developments (e.g., the rise of social media platforms, augmented reality, and large language models) and documented in scholarly research highlighting the limitations and benefits of traditional approaches (Mackenzie et al., 2012; Salgado & Galanakis, 2014; Zanudin et al., 2019).

In recent years, government authorities have grappled with crises of unprecedented scale and nature. Examples within Australia, where the study presented in this article was carried out, include bushfires and flooding across several states with devastating impacts on local communities and wildlife. The complexity of these crises and the role of human activity (Lewis & Maslin, 2015) add new dimensions to the decision-making about how to prepare for and respond to crises. This was already observed in the context of urban planning and policies in Rittel and Webber's (1973) seminal paper outlining the challenges for addressing wicked problems. When dealing with wicked problems, solutions and responses cannot be reached by following simple procedures, logic, and rules (Conbere & Swenson, 2020). Wicked problems, such as environmental crises, require a systems-focused approach (Zellner & Campbell, 2015) and involve considering diverse perspectives, long time horizons, coalitions working together, dealing with large datasets, and bureaucratic, temporal, and financial constraints (Stark & Taylor, 2014).

This article focuses on participatory workshops for engaging community representatives to inform decision-making when dealing with the wicked problem of an environmental crisis event. It contributes new knowledge by investigating the use of artificial intelligence (AI) to support collaboration and decision-making in crisis events using a simulated middle-out engagement approach that incorporates non-human perspectives. Specifically, the article investigates and compares conversational AI agents that act as facilitators and knowledge sources versus agents that embody non-human actors (i.e., a non-human living species or ecosystems). We use "actors" or "entities" in place of "stakeholders" throughout the article due to the problematic colonial history associated with the term (Reed et al., 2024). The article also reflects on the value of role-playing for simulating middle-out engagement workshops. The article addresses the following research questions:

> RQ1: What is the impact of AI-enabled tools on collaboration and decision-making in participatory community engagement workshop settings?
>
> RQ2: How can the perspectives of non-human species and ecosystems be considered in participatory community engagement workshops? What role can AI play?
>
> RQ3: What is the value of simulating a middle-out coalition for collaborative decision-making in the context of crisis events?

The article's investigation of collaboration and collective decision-making aligns with the UN Sustainable Development Goal (SDG) 17, "Partnerships for the Goals," and SDG 11, "Sustainable Cities and Communities," which entails making cities and human settlements inclusive, safe, resilient, and sustainable. Many, if not all, of the SDGs involve, require, or could benefit from more effective community engagement. Therefore, the article indirectly contributes to all of the goals and beyond. Indeed, through the focus on participatory workshops, the insights from the study can be applied to any co-design processes involving multiple actors that may represent different interests and perspectives. The following sections outline the related work and the workshop setups before presenting the findings based on data and insights collected during the workshops.

2. Related Work

The study sits at the intersection of four distinct but related areas of research: middle-out engagement, technology-supported community engagement, community engagement for crisis events, and human and non-human actors. This section provides an overview of these areas and introduces previous work that serves as a foundation for the study.

2.1. Middle-Out Engagement

Effective community engagement brings together various actors (e.g., government authorities, community organisations, citizens) to create better planning and design outcomes (Sanoff, 1999). Middle-out engagement contributes to this goal by bringing representatives from the top (e.g., government authorities) and the bottom (e.g., community organisations) together to meet in the middle (Caldwell et al., 2021; Fredericks et al., 2016). Middle-out engagement acknowledges that citymaking is a continual process and can enable systemic change through the "accumulation of many voices, actors, devices and technologies" (Fredericks et al., 2019).

A proposed format for bringing the voices together is through the formation of a coalition, which comprises representatives nominated by the affected and interested entities (Caldwell et al., 2021). For example, Gemperle et al. (2023) demonstrated the effectiveness of the middle-out engagement approach in an urban community garden project. The study highlighted how the middle-out approach promoted effective communication, aligned objectives, and facilitated collaborative decision-making within the coalition. Similarly, Dow et al. (2019) implemented a middle-out engagement approach to develop an online directory of local services for people with special educational needs and disabilities. The study aimed to connect local community members with government officials, promoting active participation and dialogue through a middle-out approach.

Building connections, integrating cultural and local perspectives, and understanding people's aspirations are essential for fostering equitable relationships (Fredericks et al., 2023). The middle-out approach facilitates the implementation of policies, infrastructure, and interactions based on the collaborative outcomes of the engagement process. The approach of aligning top-down and bottom-up actors and processes is increasingly adopted and explored in participatory planning, including within the context of mission-oriented innovation processes (Hill, 2022), making this a promising avenue for improving community resilience.

2.2. Technology-Supported Community Engagement

Previous research, primarily within the field of human–computer interaction, has extensively examined the use of digital technologies in community engagement processes. For instance, studies have investigated how social media and web 2.0 tools can enhance urban planning outcomes through digital participation (Fredericks & Foth, 2013). Research from the areas of smart cities, urban informatics, digital civics, and urban human–computer interaction has further emphasised that successful community engagement should prioritise collaboration over one-way information dissemination and should employ a range of situated engagement channels to foster inclusivity (Fredericks et al., 2018).

AI, including large language models, presents an emerging opportunity to augment community engagement and participatory workshops. Governments, private sectors, research agencies, and community groups are increasingly using AI to make sense of big data for resource and crisis management (Fan et al., 2021; Lal et al., 2022; Ye et al., 2021). Previous research has investigated the use of AI tools for automated community planning through the analysis of social media feeds (Hollander et al., 2020) and co-creating AI-powered systems with local communities in citizen science projects (Hsu et al., 2022). While this offers many potential benefits, the application of AI in cities also raises ethical and political concerns, such as questions of data privacy and ownership and the environmental impact of using energy-intensive AI algorithms (Crawford, 2021; Luusua et al., 2023). There is also a risk of AI in urban contexts penalising minorities, which requires careful deliberation about where and how to employ AI (Cugurullo et al., 2024).

The affordances of generative AI open up additional opportunities for engaging communities, which includes the use of conversational agents to support idea generation (Tavanapour et al., 2020), co-creation (Freese, 2023), and group discussion (Kim et al., 2020, 2021; Tavanapour et al., 2020).

2.3. Community Engagement for Crisis Events

Applying community engagement approaches to crisis events is a relatively new field of study. In Australia over the past few years, design researchers have been innovating with co-design (St John & Akama, 2022) and design anthropology (McGrane et al., 2022) methods in response to a range of crisis events including fires and floods (Del Favero et al., 2024). For instance, the Northern Rivers Living Lab, an initiative that began in 2023 following flooding events of the previous year, engages communities to develop "scenarios for Lismore's future that represent the hopes and dreams of the people that live and work here" (Living Lab Northern Rivers, 2023).

Governments across different countries, including Australia, tend to focus on funding physical infrastructure after crises, placing heavy reliance on established government policies (Nahayo et al., 2017; Sufri et al., 2020). This approach often neglects the valuable insights and traditional knowledge of the community, missing opportunities to develop more comprehensive and community-centred solutions. To advance crisis resilience, for instance, following flooding events, it is paramount to consider the perspectives of the local community and the lived experience of community members (Fabiyi & Oloukoi, 2013; Islam et al., 2018; Kamarulzaman et al., 2016). Technology has the potential to support this, for example, by providing an information space that is shared between volunteer groups and formal organisations (Auferbauer & Tellioğlu, 2019) or by fostering risk perception amongst communities through immersive environments (Blackler et al., 2024).

2.4. Human and Non-Human Actors

Involving human representatives from local communities is an important step towards creating better planning and design outcomes. However, similar to human-centred design, a community engagement process that only considers the human perspective risks prioritising human wellbeing above ecological considerations (Borthwick et al., 2022). When it comes to planning and design decisions in complex scenarios, the omission of more-than-human perspectives (Clarke et al., 2019; Loh et al., 2020) may lead to decisions failing to recognise critical feedback loops within the systems that are being manipulated. A review of two Australian city-region foresight strategies found that current approaches do not include non-human beings and concluded that integrating more-than-human perspectives could lead to better urban and regional sustainability outcomes (Sheikh et al., 2023).

The separation of human and non-human perspectives in the creation of knowledge is deeply grounded in Western and colonial worldviews and has shaped the disciplines of planning and design. The distinction of the "civilized" human species from other species (Tiffin, 2001), culture from nature, and cities from "the bush" and "the land" have impacted how community engagement is practised. Indigenous thinking, on the other hand, which is considered essential for sustainable development and environmental conservation, applies a relational worldview, which treats non-human beings as active members of society (Watts, 2013). Recognising this, the UN Environment Programme (Canton, 2021) has acknowledged the critical role of First Nations peoples in ecosystem management and climate change mitigation.

In Australia, "Country" refers to the lands, waters, skies, and all living things and is central to First Nations peoples' identity and culture (Foster et al., 2020, 2022). This connection to Country is not just about land ownership—it encompasses a deep spiritual, physical, social, and cultural relationship with the environment. In New South Wales (NSW), where our study is located, the government architect introduced the Connecting With Country Framework in 2023 to support government, industry, and researchers to develop connections with Country that can inform the planning, design, and delivery of built-environment projects in NSW (NSW Government, 2023). This framework proposes a Country-centred way to work, which no longer positions humans above non-humans.

3. Study Design: Speculative Crisis Scenario Workshops

To investigate the research questions introduced in Section 1, we carried out three workshops over a period of 12 months, which allowed us to reflect on the insights between workshops (Table 1). The workshops used different speculative scenarios as imaginative narratives that explore potential futures. This approach draws on principles of speculative design (Raby & Dunne, 2013) and design fiction (Sterling, 2009), employing creative and thought-provoking narratives to stimulate critical thinking about future possibilities and societal impacts. For example, the UK Ministry of Defence, in collaboration with the Defence Science and Technology Laboratory, used speculative scenarios to explore potential future threats (UK Ministry of Defence, 2023). Similarly, Tsekleves et al. (2017) investigated how speculative scenarios could help older citizens envision the future implications of policy initiatives.

Each workshop involved a different group of participants and, across all workshops, participants role-played actors and formed a coalition to collaborate on making a decision in a given crisis scenario. Ideally, personas

Table 1. Overview of the three speculative crisis scenario workshops.

	Research question	Scenario	Role of AI	# of participants	Length
Workshop A	RQ2, RQ3	Addressing one of the SDGs in a future scenario	n/a	23	3 hours
Workshop B	RQ1, RQ3	Responding to a fictional flooding event	Facilitator and providing relevant information	9	3 hours
Workshop C	RQ1, RQ2, RQ3	Responding to a fictional flooding event	Non-human representative voice	12	3 hours

are grounded in research to limit the influence of potential biases (Adlin et al., 2006; Miaskiewicz & Kozar, 2011). Due to time and resource constraints, we generated personas based on the authors' experience with community engagement projects, which represents a limitation of the study.

The study was approved by the University of Sydney's Human Research Ethics Committee. This section details the setup, procedure, and data collection for each of the workshops. The findings in the following sections are presented as a synthesis of the data collected across all workshops.

3.1. Workshop A: Addressing the SDGs Through Non-Human Perspectives

The first workshop was conducted as a pilot study to test our middle-out framework and the use of human/non-human personas for simulating a participatory workshop. The workshop simulated a coalition of top-down and bottom-up actors (assigned to participants through persona cards) tasked with developing an ideal future scenario that addresses the SDGs. Building on the related work discussed in the previous section, we designed the workshop activities to investigate collaboration with human and non-human actors, speculative scenarios to envision possible futures and outcomes, and technologies that facilitate community engagement with diverse representatives.

3.1.1. Workshop Setup and Scenario

The workshop was conducted as part of a full-day event that included a keynote speaker from the United Nations Association of Australia, followed by three interactive group activities. In this article, we focus on the first group activity, a 3-hour speculative scenario challenge that addressed the SDGs through collaboration among diverse human and non-human actors. Participants were tasked with developing an ideal future scenario related to a specific location, projected 40 years into the future. The activity aimed to encourage participants to think creatively and critically about long-term sustainability and the integration of various perspectives, including those of non-human entities, into planning and design processes.

3.1.2. Participants and Procedure

A total of 23 participants attended the workshop, representing a diverse mix of industry and academia professionals with backgrounds in community engagement, interaction design, computer science,

anthropology, and urban planning. Participants were divided into five groups of four to five members. One of the authors was the lead organiser of the workshop, another author was a co-facilitator and also acted as a participant, and another author was a participant (subsequently joining the research team for workshops B and C).

Each participant was randomly assigned a human (e.g., mayor, doctor, baker, stay-at-home parent, etc.) and a non-human (e.g., native bee, koala, river system, eucalyptus tree, AI robot, etc.) fictional character and asked to represent their perspective in the workshop. The fictional characters were provided with background information represented in the form of a persona card (Tomitsch, Borthwick, et al., 2021), which described their role within the community, backstory, and a key quote in their voice (Figure 1). Each persona was drafted in a way that gave workshop participants some subtle hints about their character's stance and the community that they were representing.

Figure 1. Human and non-human personas cards used in Workshop A as a lens to address the SDGs.

3.1.2.1. Activity 1: Introduction to Fictional Characters and Community

To help participants connect with their characters and set the stage for the subsequent speculative scenario challenge, participants within their group discussed their characters' backstories, the community they represented, and what their characters would like to get out of the workshop.

3.1.2.2. Activity 2: Developing a Future Scenario

Each group was randomly allocated a specific location (e.g., city centre, regional centre, transport hub, etc.), which formed the basis for creating their future scenario, and was asked to choose one or more SDGs to address. Participants then went on to create an ideal scenario set 40 years into the future, considering what technologies might be included (existing or new), what society might be like, and what efforts would be made to address the chosen SDGs—representing their ideal future scenarios both through a written narrative and annotated visuals (Figure 2).

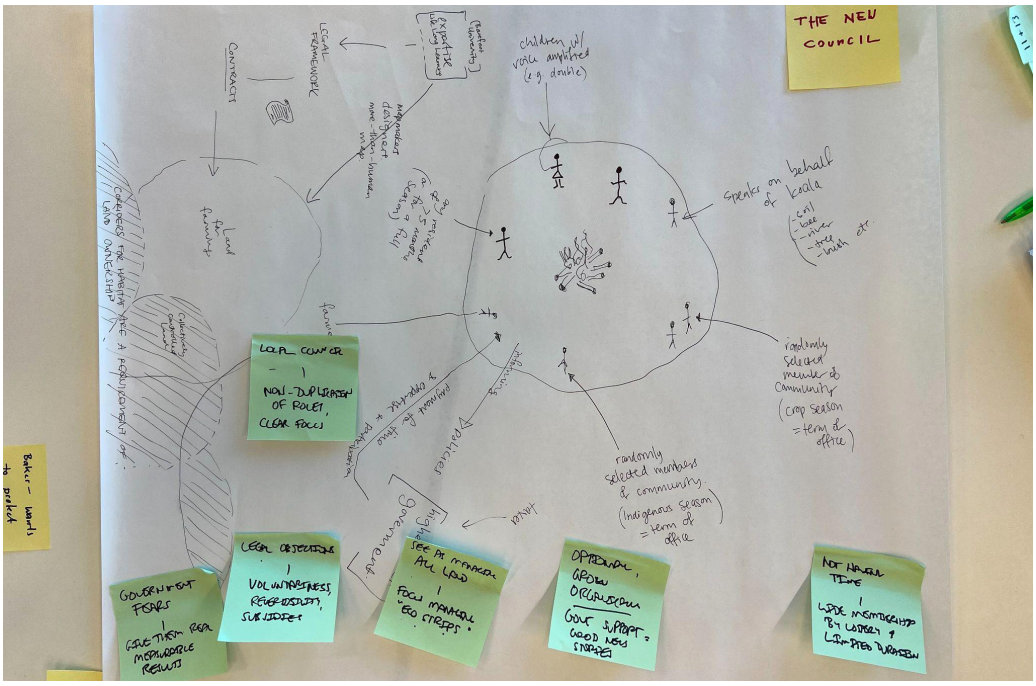

Figure 2. One of the visual future scenarios developed by a group of Workshop A participants.

3.1.3. Data Collection and Analysis

After the workshop activities, we conducted small discussions with each group individually to gather feedback on the activities, participants' experiences, and the effectiveness of using speculative scenarios and representing diverse human and non-human characters through personas. We also discussed the impact of representing diverse human and non-human characters and how this approach influenced their perspective on the scenarios. Data was collected through observations and note-taking during the workshop. The analysis was conducted through post-workshop reflective discussions between the three authors involved in Workshop A.

3.2. Workshop B: Using an AI-Powered Conversational Agent as a Facilitator

The second workshop also implemented a middle-out approach with participants role-playing fictional human community representatives. In addition, it investigated the use of conversational AI agents to enhance collaboration and support decision-making in crisis event situations.

3.2.1. Conversational AI Prototype

Given our focus on face-to-face community engagement workshops, we considered it important that the AI component did not introduce any additional technological complexity or hinder the flow of the discussion. Rather than workshop participants interacting with AI through their personal devices, we were looking for a technology that would allow multi-user interaction and integrate with the existing props and tools used in community engagement workshops, such as sticky notes and (interactive) whiteboards. We therefore opted for a conversational AI agent using natural, spoken language as the interaction modality—akin to Apple's

virtual assistant Siri and Amazon's smart home service Alexa. While predominantly used for dyadic interaction following a request–response paradigm (Ammari et al., 2019), recent research studies highlight the potential of implementing multi-party interactions with conversational agents (Addlesee et al., 2024, 2023; Seymour & Rader, 2024; Skov et al., 2022).

We conceived the agent—referred to as "Sage"—to carry out two functions: first, to provide data-based insights, and second, to take on the role of a (co-)facilitator, which involved, for example, encouraging balanced contributions and mediating conflicts. We implemented the agent as a Wizard of Oz prototype, whereby one of the research team members was located in a remote control room with their voice streamed to a Bluetooth speaker (Figure 3). We embedded the speaker inside a custom-made device made of laser-cut wooden and acrylic material to embody a physical presence. An LED light ring displayed blue–green ambient light patterns whenever Sage was speaking. The team member acting as Sage's voice was instructed to make Sage sound AI-like (similar to Siri and Alexa). ChatGPT was used to generate both pre-prepared and on-the-spot answers, which the team member acting as Sage then read out.

Figure 3. Participants in Workshop B interacting with the conversational AI agent Sage and the paper-based prototype representation of the tabletop displaying the map of Casuarina Waters.

3.2.2. Workshop Setup and Scenario

To test the efficacy of an AI agent in a participatory community engagement workshop setting, we split the session into two activities, with the first being facilitated by a human moderator and the second being augmented by Sage. The workshop scenario focused on a major flooding event in a fictional suburban community named Casuarina Waters. An actual flooding that occurred in a regional town in the Australian state of NSW in 2022 combined with a place-based approach to the map design (Vanni & Crosby, 2023) informed the development of the speculative scenario, ensuring that the context was both believable and relevant to participants. The task for the participants was to debate whether to rebuild Casuarina Waters or relocate to Casuarina Heights, an area on higher ground that was still within the river catchment.

3.2.3. Participants and Procedure

We recruited nine participants to join the workshop. All participants were industry professionals with prior experience in community engagement through their professional roles. Seven research team members supported the workshop, with three members role-playing community engagement manager during the workshop, two members operating the technical aspects of Sage, one member acting as the voice of Sage, and one member taking photographs.

Upon arrival, participants were introduced to the high-level goals of the research study without giving away any details about Sage. Each participant was assigned a fictional character and asked to enact this role until the end of the workshop. Similar to Workshop A, the fictional characters included background information represented in the form of a persona card, describing their role within the community, backstory, likes and frustrations, and motivations. The cards provided workshop participants subtle hints about their character's stance and the community they represented, without coercing participants into taking a position on the workshop outcome. Participants selected a photograph for their persona from a collection of provided portraits, names, and genders. To help them connect with their character, one of the research team members facilitated a 2-minute meditation exercise inviting participants to consider how their character arrived at the workshop, what they had for breakfast, etc. Following this, we started the role-playing exercise by welcoming participants (now acting as community representatives) to the community engagement workshop and playing a fictional TV news report video covering the impact of the flooding event on Casuarina Waters.

3.2.3.1. Activity 1: Existing Community Engagement Platform

After the introduction, we commenced with the first activity in which representatives had to consider the advantages and disadvantages of rebuilding versus relocating Casuarina Waters. This activity was moderated by the three team members acting as facilitators. Participants were seated around a large table on which we placed an A2-size paper-based prototype of an interactive tabletop application. The design of the prototype was inspired by the digital online community engagement platform Social Pinpoint, which allows users to add pins on an interactive map to indicate areas of concern and suggest improvements for a specific location. The prototype initially "displayed" a map of Casuarina Waters. Participants could request the workshop facilitators to "swap" the displayed map to show Casuarina Heights as needed. We asked participants to use yellow and blue sticky notes to "pin" benefits and disadvantages that they could see for their community when rebuilding Casuarina Waters in its current location versus relocating to Casuarina Heights. 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 approximately 30 minutes.

3.2.3.2. Activity 2: AI-Augmented Community Engagement Platform

After a 15-minute break, we began the second part of the workshop in which we introduced our conversational agent Sage. Participants were not aware that one of the team members acted as Sage to provide the impression that Sage was a fully functional conversational AI agent. Participants were asked to further discuss whether to rebuild or relocate Casuarina Waters while working towards a consensus. The three workshop facilitators continued to moderate the session, with Sage being introduced as a co-facilitator and knowledge hub to provide any information that representatives 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 facilitated this activity by handing out a prompt card to each representative with relevant example questions. For instance, a participant representing a water engineer received a prompt to ask about the potential for more sustainable water infrastructure in the event of relocation. We also used behaviour cards (e.g., "Pound table and disagree") to simulate reactions as a way to explore different group dynamics. The duration of this activity was approximately 45 minutes.

3.2.4. Data Collection and Analysis

After the workshop activities, we invited participants to step out of the characters they had played and conducted a 35-minute focus group discussion about the use of speculative scenarios, participants' experience of role-playing their assigned characters, and the potential of AI to enhance community engagement. For data analysis, we used the qualitative data analysis tool Dovetail to analyse both the recording of the workshop activities and the post-study focus group discussion. We followed a deductive thematic analysis approach (Braun & Clarke, 2012) that was conducted by one researcher. After an initial set of codes and themes were developed, we discussed the results in a meeting with the larger research team.

3.3. Workshop C: Using an AI-Powered Conversational Agent to Represent a Non-Human Actor

The third workshop used the same speculative scenario as Workshop B, requiring community representatives to form a middle-out coalition and arrive at a collective decision to rebuild Casuarina Waters or relocate to Casuarina Heights. We designed this workshop to investigate the use of conversational AI agents to act as a member of the coalition, representing a non-human actor. The workshop was carried out as part of the afternoon section of a full-day workshop held in conjunction with an academic conference. The morning involved a series of talks and discussions, including presentations on non-human personas, which helped set the scene for the speculative exercise.

3.3.1. Conversational AI Prototype

We employed Sage for this workshop, using the same prototype and Wizard-of-Oz approach. Based on insights from Workshop B and as here the agent was representing a non-human actor, we decided on using a friendly-sounding non-artificial voice instead of an AI-like voice. Again one of the research team members was placed inside another room equipped with a live audio and video feed of the workshop space and ChatGPT was used to generate answers. We decided for Sage to represent the river wetland and to speak on behalf of its non-human species. To bring these perspectives into the workshop and determine potential responses to participant questions, we conducted background research on the river that served as an inspiration for the Casuarina Waters scenario. In practice, this could involve developing an "ecosystema" (Tomlinson et al., 2022) to capture the complex aspects of an ecosystem, which then informs the behaviour of the AI agent.

3.3.2. Workshop Setup and Scenario

The workshop involved two activities. First, we asked participants to develop a charter for their middle-out coalition. We added this component based on insights from Workshop B, which found that participants did not act as a coalition but rather as individuals on behalf of the community they represented (e.g., local shop owner). The second activity involved all participants (including Sage as the wetland) identifying the benefits and disadvantages of rebuilding versus relocating and working towards a collective decision. The scenario was exactly the same as in Workshop B, focusing on a flooding event that had occurred in the fictional suburb of Casuarina Waters.

3.3.3. Participants and Procedure

Twelve people participated as community representatives in the workshop. The research team comprised four members, with two acting as the community engagement workshop facilitators, one member acting as Sage's voice, and one providing support for the agent setup (e.g., controlling the lights on the agent). Two additional conference attendees took photos to document the workshop activities and assisted with the workshop (e.g., swapping out the map in the paper prototype). We used the same persona cards and process of assigning participants their character and introducing the scenario as for Workshop B.

3.3.3.1. Activity 1: Developing a Middle-Out Coalition Charter

The two facilitators asked participants (now role-playing their characters) to record their aspirations for working together as part of a coalition. This involved participants discussing provided value cards in small groups, before sharing their discussion with the wider group and placing their cards on a whiteboard (Figure 4). As people presented and added their cards, the two facilitators guided them to group the cards to identify themes, with the aim of agreeing on core values, goals, and key attributes for the coalition and the decision-making process. This activity took about 30 minutes.

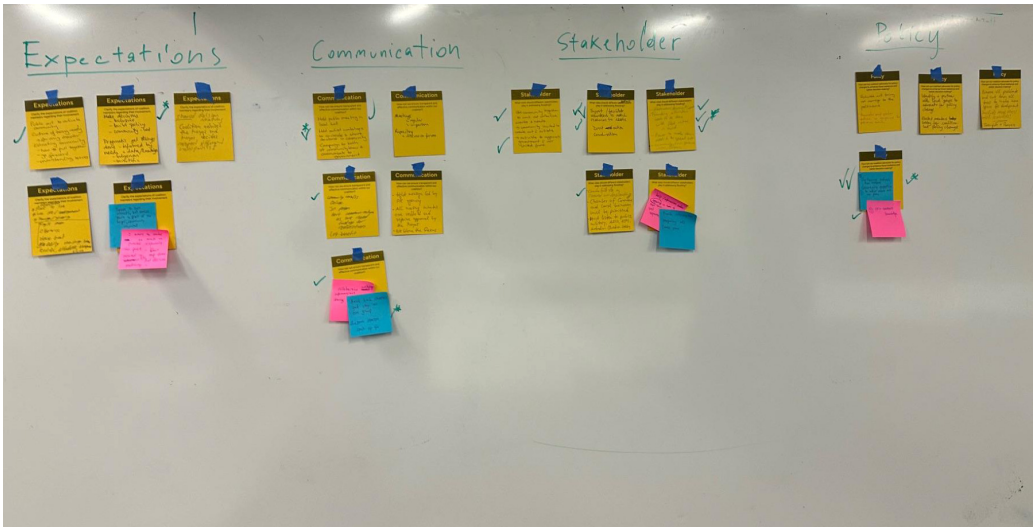

Figure 4. The middle-out coalition charter, which was created by Workshop C participants while acting out their representative roles, capturing the values, goals, and key attributes for the coalition and the decision-making process.

3.3.3.2. Activity 2: AI-Augmented Community Engagement Platform

Following the charter activity, we introduced the paper prototype (showing the maps of Casuarina Waters and Casuarina Heights) and Sage to the participants. Participants were invited to stand around the table on which we placed the paper prototype (Figure 5) and to use sticky notes to "pin" their comments while also discussing them with the other participants. Sage introduced itself as the river ecosystem and throughout the activity answered questions and also at some points interjected to provide additional perspectives. Participants were asked to reach a consensus and record their decision by positioning themselves on a line within the room with the two ends representing rebuilding and relocating. This activity lasted around 40 minutes.

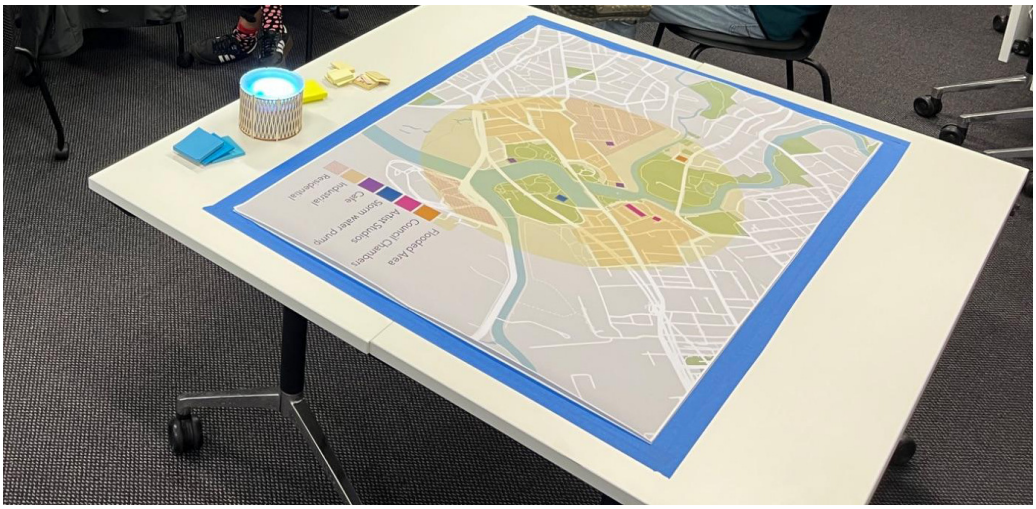

Figure 5. The conversational agent prototype Sage and the paper prototype of the tabletop community engagement platform displaying the map of Casuarina Waters set up for Workshop C.

3.3.4. Data Collection and Analysis

Similar to Workshop B, we conducted a post-study focus group to discuss the efficacy of the simulated middle-out engagement process and the representation of a non-human actor using a conversational agent. The focus group discussion lasted 25 minutes in total. Data was recorded and analysed in the same way as for Workshop B, ensuring a level of consistency and comparability between the two workshops.

4. Enhancing Collaboration and Decision-Making

This section presents synthesised findings from Workshops B and C about the use of AI in participatory workshops to enhance collaboration and support decision-making (RQ1). In Workshop B, before Sage, the conversational agent, was introduced, representatives were arguing their case and forming alliances with those who shared similar interests. Interestingly, after Sage was introduced, the group dynamic changed in several ways. First, instead of having an engaged group discussion (often with representatives interrupting each other), participants turned to talk to Sage, who became the centre of attention. While Sage made remarks in its facilitator role or answered questions, all participants stopped talking and listened to the sometimes very lengthy ChatGPT-generated responses, "watching it when it was speaking like it was a face" and feeling they had to "be polite and listen." This was perceived negatively and described as a sense of "being trapped" listening to the agent. Second, we noticed a bonding amongst all the representatives in a

way that we had not observed before the introduction of Sage. This became especially pronounced when Sage started pushing the participants to make a decision.

In Workshop C, where Sage was introduced from the start as a member of the coalition, we observed very different dynamics in terms of how the human representatives related to each other and Sage. Though, as one participant noted in the focus group, it may have been even better to introduce Sage before the charter activity. As in Workshop B, all representatives listened to Sage when the agent was speaking. However, Sage was treated more like a member of the coalition and also seen that way, as confirmed during the focus group: "I did feel that it was a member because of the style of how it was speaking." There may be two factors at play—on the one hand, Sage represented a non-human member of the coalition rather than a facilitator, and on the other hand, Sage had a warm, friendly non-artificial voice. This observation also points to the potential emergence of new human–machine relations enabled by AI (Crandall et al., 2018; Cugurullo et al., 2024).

We also observed that the use of a conversational agent across both workshops changed the group dynamics. One way this manifested itself was by participants quoting Sage to mediate heated disputes. For example, in Workshop B, the mayor stated "hey, hey, hey, hey, she said speak respectfully…let's just make the conversation calm." Interestingly, this observation suggests that the agent (as a facilitator) is assigned a status of power beyond that of the human representatives in the room. Another way the AI agent changed the group dynamic was by "taking the power out of the room" as one participant put it, referring to one of the representatives who became the "squeaky wheel" before the introduction of Sage.

In Workshop B, participants did arrive at a decision, pressured by Sage. However, during the focus group, they commented feeling coerced into having to make a decision. Therefore, while agents as facilitators have the ability to lead a group towards making a decision (as also found in the study by Kim et al., 2021), this may not be the best outcome for a participatory process. It also introduces problematic ethical concerns as potential biases stemming from the underlying large language models may push participants into making a decision that is based on the AI's biased information that is being provided to participants. This demonstrates the importance of having human facilitators and participants in a community engagement process rather than entirely replacing human involvement with AI. While there is emerging research on using generative AI for qualitative research purposes—for example to generate user personas (de Winter et al., 2024)—there is also criticism that AI cannot replicate the richness of human experience such as affect and embodiment (Gibson & Beattie, 2024). This was also echoed by one of our participants who noticed a lack of empathy in the responses from Sage, simply because they "can't get a feeling from it [and] can't sense it."

In Workshop B, participants asked Sage questions to help them make a decision, for example, "Could you please tell me how long it will take to relocate?" Compared to participants using AI on their personal devices, having this conversation with Sage in a group setting enabled a wider discussion and for participants to have access to the same information. To that end, Sage also successfully acted as a source of data-based insights; for example, the mayor in Workshop B asked, "Can you please give me an example of a town that has relocated successfully in Australia and what made it successful?" to which Sage was able (with the help of ChatGPT) to provide the story of a town relocating in the 1950s to make space for a power station in the Snowy Mountains.

Previous work has mainly investigated the use of conversational agents in group chats and online group discussions (Kim et al., 2020, 2021). While some of our findings are consistent with those studies, we also

found some key differences. For example, in an online chat, both the human and chatbot are only using text for communication, whereas, in our case, 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. Interestingly, we were able to partially reduce this imbalance by introducing Sage as part of the coalition in Workshop C and using a friendly-sounding non-artificial voice instead of an AI-like voice.

5. Bringing More-Than-Human Perspectives Into Participatory Planning and Design

In this section, we draw on Workshops A and C to discuss the use of non-human personas and the role of AI in considering more-than-human perspectives in community engagement workshops (RQ2). Workshop A involved each participant describing their human and non-human persona cards to the rest of the group. We found that during this step some participants used the first person to present both their personas. This likely helped the participant as well as the group to empathise with the perspectives of the non-human persona. Interestingly, this stands in contrast to some of the literature suggesting that non-human personas (unlike human personas) should be written from a third-person perspective to signpost that their description is provided through an anthropocentric lens (Frawley & Dyson, 2014; Tomitsch, Fredericks, et al., 2021). Throughout the participatory design exercise, participants referred to their personas, keeping them in front of them, and in some instances, adding them to their speculative design sketches. As observed for human personas, having those character cards helped keep their perspectives front and centre throughout the design process (Adlin & Pruitt, 2010; Miaskiewicz & Kozar, 2011).

Workshop C embodied and brought to life a non-human persona (representing the wetland ecosystem) through a conversational AI agent. Our approach aligns with previous work investigating the use of technology to amplify the agency of plants (Sheikh et al., 2021). Our Wizard of Oz prototype and setup seemed to successfully achieve this, as evidenced by participants' comments during the focus group. Interestingly, participants in the focus group discussion referred to the agent as "Sage" whereas in the discussion following Workshop B, participants referred to the agent mostly as "AI." This may have been helped by the agent exhibiting a non-artificial voice in Workshop C. Participants commented positively on aspects such as a "stutter" and "emotion" carried in the voice, making it feel more real and "convincing." Some participants suggested that other voices may be more suitable, making Sage sound less human or like a little girl to represent "emotional value" or an Indigenous voice to convey "knowledge" or a "kind of magical voice that comes from another world." Interestingly, one person from Workshop C proposed a more synthetic voice, warranting further investigation. The physical manifestation—Sage looking somewhat similar to voice-based assistants, such as Alexa or Google Home—might have had some effect on how participants perceived and interacted with Sage.

The fact that in Workshop C Sage every now and then interjected the participant discussion to add its perspective, seemed to have a similar effect to the tangible persona cards in Workshop A, helping to keep nature's perspective in mind. As one participant observed: "The way it sort of, every now and then speak to us…it reminded us this sort of agency of, of the nature." It also prompted participants to empathise and reflect on the more-than-human perspective, asking themselves "whether [the wetland] has a vote" and contemplating the "different species [living] in the wetlands." One participant proposed that Sage could have been even more proactive in suggesting different perspectives.

The pluralism of AI agents and their perspectives is constrained by the underlying AI models and the fact that these models are trained on human language. On the one hand, as Klein and D'Ignazio (2024) argue, this is due to the narrow demographic composition of AI researchers and because of the imbalance of power between those currently designing AI systems and those subject to their decisions. It is important to be mindful of potential biases stemming from those underlying factors and how they might affect an AI agent's position, which could perpetuate existing inequalities (Capraro et al., 2024; Wach et al., 2023). These risks can be mitigated through either pre-processing the input data or post-processing the AI-generated outputs (Ferrara, 2023). However, in practice this is difficult and time-consuming to achieve—highlighting the need for further research.

On the other hand, AI itself is also a non-human actor (Giaccardi & Redström, 2020; Nicenboim et al., 2020) as are councils and other organisational entities involved in a participatory process. Latour (2018) proposed the notion of a "parliament of things" to recognise and represent all non-human entities, including animals, plants, and inanimate objects. In Latour's (2005) actor-network theory, organisations are seen as networks of diverse actors, which represent both human and non-human entities. This also highlights the complex politics of using non-human voices as those voices will always remain based on human-generated or human-filtered datasets. In other words, the perspective of the non-human cannot really be captured by current generative AI models as AI is trained on human language.

The integration of First Nations knowledge also represents an important consideration for future work on representing non-human voices. In Section 2, we reference "Country" as a framework to acknowledge the challenges associated with conflicting knowledge paradigms. As non-Indigenous researchers, we cannot represent Indigenous knowledge itself, but we can recognise its importance, and we can incorporate diverse perspectives, including those of non-human actors in our research design. This ensures that decisions are made with a broader understanding of the interconnectedness of all elements within the environment.

6. Simulating a Middle-Out Coalition for Collaborative Decision-Making

This section reflects on the approach used across all three workshops to simulate a middle-out coalition with participants role-playing assigned characters (RQ3). In Workshop A, we did not enforce the role-playing and solely provided participants with the persona cards without prompting them specifically to act out their characters. Perhaps, this removed a potential level of awkwardness of participants having to step into a role and act. However, some people on their own decided to assume a first-person view and speak from the perspective of their assigned personas. We observed people moving in and out of these roles. However, the majority of the time participants worked on the design challenge as workshop attendees rather than acting out the personas.

Interestingly, none of the participants from Workshop B and C, where we asked people specifically to act out their assigned character, reported any feeling of awkwardness. The fact that the members of the research team also took on a character and the meditation exercise we used to help participants connect with their character may have helped with this. Indeed, we observed that participants really enjoyed acting out their characters. They augmented the background story they were given and added additional details to their character, turning facts into stories. This sometimes caused internal conflicts, as one participant shared in the focus group, stating that they thought the wetland really should be pushed to be "the most important voice" but because they were acting as a city planner representative, they felt they "had to temper that enthusiasm."

This connection with their character was also evident from the questions that participants posed to Sage. For example, in Workshop B, one participant enquired, "It's Jenna, the mayor, could you please tell me how much it's gonna cost to relocate to Casuarina Heights?" Specifically, participants asked questions that would help their character to make an informed decision about rebuilding versus relocating, such as "How likely will…it be that my studio floods again?" and "Will there be a gallery if Casuarina is relocated?"

Forming an actual coalition with representatives from the top and bottom can be a difficult and time-consuming undertaking. Including voices that can speak on behalf of non-human actors adds even further complexity. There is also a risk that when dealing with crisis situations, the experience of participating in a workshop may resurface traumas. We are not advocating against going through this effort and implementing trauma-informed and culturally sensitive and safe participatory processes (Champine et al., 2022). Neither are we proposing to take shortcuts, which may lead to ill-informed decisions with poor outcomes. The value of role-playing in AI-supported workshops is limited by how researchers coordinate these activities in practice and the limited role that AI and simulation can play (as discussed in Section 5). However, we are suggesting that based on our experience of using simulated middle-out coalitions in complex scenarios, role-playing may be a valuable first step to gather initial insights, which can be taken back into the actual project and inform further action. Furthermore, it can be an effective approach to rapidly prototype and explore the potentials and pitfalls of new technologies for community engagement before deploying them in real-world settings. This is akin to science fiction prototyping (Johnson, 2011) and role-play workshops when designing interactive technologies (Seland, 2009).

Dealing with complex scenarios framed through the lens of the SDGs brings many challenges, including disagreements on local priorities, competing interests among different actors, and potential risks due to uncertainties (Moallemi et al., 2020). To tackle these challenges, Moallemi et al. (2020) propose a transdisciplinary approach, which consists of three pillars—joint framing of local goals and actions, evaluating critical uncertainties, and co-creating adaptive pathways. These pillars offer a framing that can be incorporated into future speculative community engagement workshops that address the SDGs through role-play, applying a transdisciplinary approach that integrates an AI-augmented middle-out engagement approach.

7. Conclusion

This article investigated the role of AI as an emerging technology in community engagement workshops focused on building resilience. For example, a flooding event may require various actors to decide whether to rebuild or relocate. Through our study, which involved simulating a middle-out engagement approach, we found that an AI-powered conversational agent can effectively (co-)facilitate the discussion amongst a diverse group of community representatives, providing data-based insights that can help the group in making a decision, and ensuring a balanced contribution of all members. Our findings highlight potential advantages in introducing an agent as a member, embodying a non-human actor, compared to using the agent as a facilitator. Through this approach, the agent can positively influence the group dynamic while also acting as a readily accessible knowledge resource.

Importantly, the article raises several challenges associated with the use of AI in participatory workshops that require further investigation. Those include challenges raised in the broader literature on AI (Crawford, 2021; Wach et al., 2023) that are pertinent to using AI to support collaborative decision-making, such as the risk of

potential biases inherent in the underlying models and coercing participants into making a decision through a skewed representation of data. The energy required to drive AI systems further remains a challenge that cannot be ignored especially when dealing with crisis events linked to the ongoing climate crisis. The article also reflected on the limitation of using human-generated or human-filtered data as a basis for representing non-human actors.

One of the targets of SDG 17, "Partnerships for the Goals," refers to mobilising and sharing knowledge. While there are benefits from doing this across countries as stipulated in the target description, the value of local knowledge cannot be underestimated. The AI-augmented middle-out engagement approach described in this article enables this mobilising and sharing of knowledge specifically within the setting of participatory workshops, bringing together perspectives from authorities and grassroots organisations and local community groups as well as those that are non-human yet fundamental to consider when dealing with long-horizon challenges and building resilience for all.

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Conflict of Interests

The authors declare no conflict of interests.

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About the Authors

Martin Tomitsch is head of the Transdisciplinary School at the University of Technology Sydney, and founding member of the Media Architecture Institute, the Urban Interfaces Lab, and the Life Centered Design Collective. His books include *Making Cities Smarter*, *Design. Think. Make. Break. Repeat.*, and *Designing Tomorrow*. Through his work as a design academic and educator, he advocates for the transformative role of design as a framework to imagine speculative futures and drive positive change.

Joel Fredericks is a senior lecturer in design at The University of Sydney's School of Architecture, Design and Planning. His research investigates the interaction between people, place, and technology, focusing on community engagement, co-design, emerging technologies, and non-human perspectives in design. Joel has authored numerous publications, including *Media Architecture Compendium* (Vol. 2). Through his research and teaching, he promotes collaboration between diverse representatives to achieve inclusive design outcomes and collective decision-making.

Marius Hoggenmüller is a lecturer in interaction design at the Design Lab, School of Architecture, Design and Planning, University of Sydney. His research focuses on designing and prototyping interactions with emerging technologies, such as robots and autonomous systems, with a special emphasis on interaction design for public urban spaces. He received his PhD from the Design Lab and holds a BSc and MSc in media informatics from Ludwig Maximilian University of Munich.

Alexandra Crosby, University of Technology Sydney, is an internationally recognised design anthropologist and visual communicator. Her current body of research is focused on more-than-human design and recombinant ecologies in urban environments. She explores and contributes to systems and ecologies that will be critical to overcoming the impacts of climate change on our cities. Key projects include Surfacing Urban Wetlands in Two Urban Renewal Sites in Sydney, and Mapping Edges, a transdisciplinary research studio in partnership with Associate Professor Ilaria Vanni.

Adrian Wong is an associate lecturer in emerging technologies at The University of Sydney's School of Architecture, Design and Planning. His research focuses on applying artificial intelligence to solve complex problems, particularly in high-stakes decision-making contexts. He teaches design thinking and design for innovation where he empowers students to think critically and creatively, equipping them with the tools to innovate, lead, and shape the future of design.

Xinyan Yu is a PhD candidate at The University of Sydney's School of Architecture, Design and Planning. Her research investigates human–robot interaction in urban public spaces, focusing on fostering casual collaborations between bystanders and robots. Through her research and design investigation, she advocates for a design perspective that promotes symbiotic relationships between humans and machines.

Weidong Huang received his PhD in computer science from The University of Sydney. He is currently an associate professor at the University of Technology Sydney, Australia. With over 150 publications, his primary research interests lie in human–computer interaction and data visualization. He focuses on designing and evaluating visualizations, user interfaces, and interaction methods that integrate data insights with human intelligence, enabling effective data exploration, communication, and decision-making.