Robots For Everyday Life: Children's Visions on Roles of Robots

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Abstract

Children bring a distinct and underexplored perspective to questions about how robots could add meaning to everyday life. We report on a participatory design workshop with 14 children, from Innovators for Purpose (iFp), an afterschool program primarily catering to underrepresented groups in STEM (Science, Technology, Engineering, and Mathematics). We used personal photo probes and a scaffolded speculative design process to elicit and capture how children imagine robots adding value to their everyday lives. Introducing the concept of robots only after participants had articulated their values and challenges, we captured their robot concepts grounded in their everyday experiences. The imagined robots concepts fell within four categories: (1) automating tasks associated with hobbies, (2) fostering environmental stewardship, (3) enhancing educational experiences, and (4) enforcing digital well-being. We illustrate the process of constructing these themes and uncover the values animating these designs. We discuss how the values may conflict and be negotiated, and the reflexive nature of imagining robots as part of everyday life. We contribute a methodology for eliciting value-based speculative design with children and discuss how children imagine future technology.

CCS Concepts

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

Keywords

Robots, children, participatory design, speculative design, photo probes, generative AI.

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1 Introduction

Robot design often reflects the values and lived experiences of technologists who create them [9], which can produce unexpected limitations when these technologies encounter diverse communities [4]. Moreover, some HRI studies are conducted with technically familiar participants [21], leaving an opportunity for more inclusive approaches to robot design. We address this gap by engaging participants from the Innovators for Purpose (iFp), a program catering to underrepresented children, in a participatory workshop geared towards envisioning how robots could meaningfully support them in their everyday lives. Through a scaffolding activity flow in which the notion of robots was introduced after participants had articulated their own values and challenges, participants co-created concepts of robots aided by a Generative AI tool and grounded in their own lived experiences. We found that participants' designs were informed by their visions of environmental stewardship, the automation of difficult tasks associated with their personal hobbies, and support around learning and digital well-being. We contribute a methodology to elicit how children imagine robots within their everyday environments using photo probes and Generative AI image model outputs. We complement our methodological contribution with artifacts depicting robot concepts developed during the workshop, and a thematic analysis of empirical data revealing tensions between different values should these robotic concepts be realized. With these contributions, we extend prior work using participatory and speculative approaches to design robots with children.

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2 Related Work

2.1 Child-Centered Robot Design

Robot design frequently overlooks the developmental and social perspectives of younger users. Wood [25] found that traditional design markers (e.g., facial features), failed to help children distinguish robot emotions or intents, even among children who regularly engaged with robots in competitive settings. This suggests adult-led conventions are not merely insufficient for children, but misaligned with how they interpret and relate to designed objects. If robots are to integrate meaningfully into children's social domains, design processes must move beyond treating children as passive users. While prior literature focused largely on functional utility of social [1] and educational robots [3], a growing body of work frames child-centric design as a fundamental human right [8] and advocates for approaches that account for the social, cultural, and economic factors shaping technology use and simultaneously influencing the construction of values [12, 24]. Alves-Oliveira et al. offer five design principles for child-robot design including playfulness and use of age-appropriate objects [1]. Our work extends these principles by grounding ideation directly in participants' envisioning of robot concepts for their everyday lives.

2.2 Participatory Design as a Tool For Eliciting Children's Values

Participatory Design (PD) [18] and artifact-oriented techniques such as photo-elicitation or cultural probes [6, 13] allow participants to anchor values in tangible personally meaningful imagery.

These methods have been used in the context of robot design with children. Björling and Rose as well as Rose et al., for example, engaged teens in and out of schools in designing scenarios and scripts for robots meant to support mental health [5, 20]. Similarly, Gillet et al.'s study of how robots can mediate group dynamics engaged teenagers in focus groups and interviews to elicit their perspectives which were then deployed in a tele-operated robot [14]. We extend this participatory foundation in two ways. First, we add to efforts to include historically marginalized populations in the design of robots [16], by partnering with an organization catering to underrepresented students in Science, Technology, Engineering, and Mathematics (STEM). Second, we use speculative design techniques [11] to deliberately remove technical constraints and empower children to envision future robots driven by their own values rather than existing technological limitations.

3 Selection and Participation of Children

We partnered with an after-school program to conduct this study. In total, there were 17 participants, including 3 adult teaching assistant instructors who support the after-school program. These instructors were assigned to a separate working group during the workshop, and their data were excluded from the analysis. Therefore, this manuscript reports data from 14 participants. Of these 14 participants, one was 18 years of age or older, while the remaining 13 were high-school aged students. Parental consent was obtained for all minor participants, and the participant aged 18 or older provided their own informed consent to participate in the study. Additionally, we worked with the after-school program directors to determine what would be most valuable to them, and we learned that including a career talk and a tour of the robotics lab would benefit the participants. Therefore, the workshop included a tour of the robotics lab led by three seasoned roboticists and engineers who shared how they became roboticists and answered questions about their career journeys.

4 Methods

All parts of this study were approved by an Institutional Review Board (IRB). Probes and study instruments were tested in a pilot study, and iterated prior to the workshop. All participants (N=14) were recruited through a partnership with Innovators for Purpose (iFp)[1], an afterschool program catering to young people, especially from underrepresented groups in STEM. The workshop used a combination of elicitation tools and design prompts. The flow of activities is shown in Figure 1. Before the workshop, participants were invited to a virtual session during which they were instructed to submit photos that were meaningful and representative of their everyday lives, to be used as probes. These photos could show activities or tasks that felt difficult, as well as activities that were easy, enjoyable, or satisfying. Participants were instructed to choose photos they felt comfortable sharing and discussing in a group setting. To protect privacy, photos of people who had not given consent were not allowed, including images that could identify any person (e.g., faces or name badges). To avoid capturing identifiable images, participants were instructed to photograph symbolic locations or objects associated with the individual in question, rather than the individual's likeness.

[1] https://innovatorsforpurpose.org/

4.1 Workshop Structure

Participants were provided with a 6-page worksheet to structure their progression through the workshop while documenting their thoughts and discussions. The worksheet included spaces for text-based entries and drawings. Participants received a $50 gift card upon completion of the 3-hour workshop. See Table 1 and Figure 1 for summary on workshop structure and workshop activities.

4.2 Workshop Data and Data Analysis

Data sources included participant photographs, in-workshop audio recordings, completed worksheets, two Google Forms (one for Gemini inputs and the second for feedback on AI-generated robot images), and Gemini-generated images. Worksheet responses were transcribed using HTR via Google Gemini Studio [2, 22]. Transcriptions were verified for accuracy by the first author. Visual data were organized in Miro and analyzed using inductive thematic analysis [7], with the first author iteratively mapping recurring robot concepts and points of tension. Audio recordings, transcribed via OpenAI's API, were used to contextualize and refine themes rather than coded directly. Survey responses were analyzed using the same thematic approach.

5 Findings

We found that participants imagined robots taking on four main roles in their everyday lives: as automators, stewards, support systems, and enforcers. While some robot roles envisioned by participants pose substantial engineering challenges given current capabilities, the aim of this study is not to evaluate technical feasibility. Rather, our findings foreground how people envision robots in their everyday lives, deliberately unconstrained by present-day technical limitations, surfacing what roles participants find meaningful as generative inputs for future design directions.

5.1 Robots as Task Automators

Participants imagined robots that could automate difficult or technical parts of meaningful experiences or hobbies—robots handled tasks such as detecting failures, cooking, or measuring portions, allowing participants to focus on creativity, learning, enjoyment, and preservation of family connection. These robots were not designed to replace the hobby itself but to play supportive roles. *Breadmaker3000,* for example, copies a mother's specific cooking technique and teaches it to children. Participants described it as a robot that learns exactly how a mother cooks and is able to teach a child these techniques when she is not available to do it. *"Because I wanted it [Breadmaker3000] to make the bread the way my mom makes it because that's what I enjoy."* Here, the role of the robot reflected values of preserving family connection through mastering a particular practice. *Parts4U,* on the other hand, helped children who loved biking to identify and locate accurate parts to fix their bicycles, supporting independence and problem-solving while reducing physical and technical barriers. *"I would say it [Parts4U] would help me find pieces for my bike."* Across these concepts, participants framed robots as partners rather than replacements.

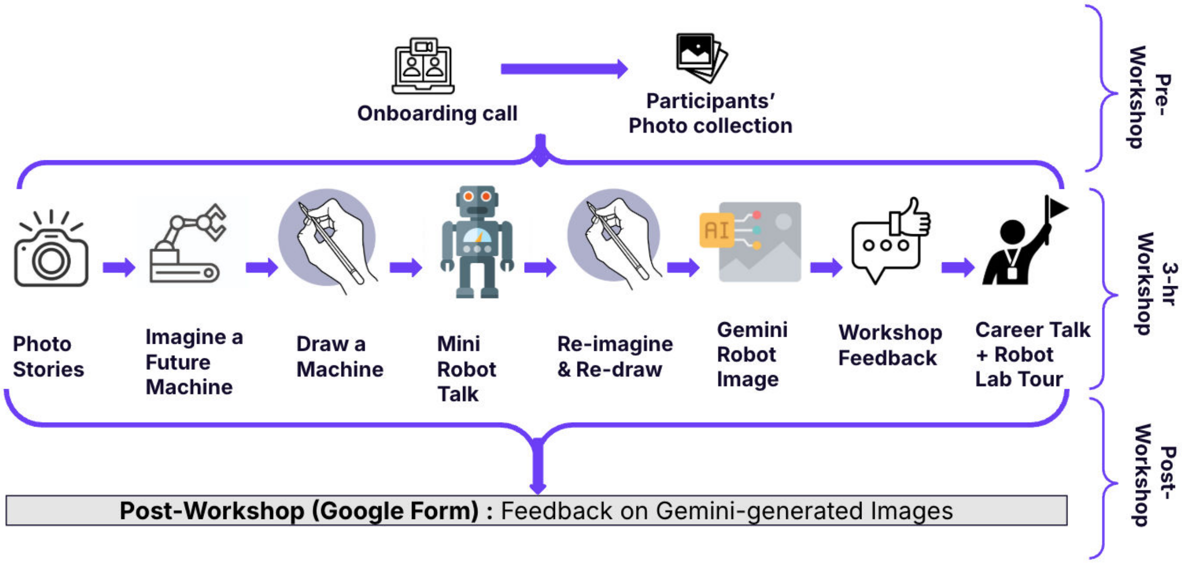

Figure 1: Study flow showing pre-workshop activity, structure of the 3-hr workshop session, and post workshop activity

Activity	Description
Photo stories	Participants began by describing a personal photo to their peers, identifying challenges or opportunities as they surfaced and summarizing these in a one-sentence problem statement.
Imagine a future machine	Participants revisited their one-sentence statement and imagined a future in which a machine existed within the context of their photo.
Draw a machine	Participants sketched the future machine they had imagined.
Mini robot talk	The first author gave a mini robot talk to expand participants' awareness of form factors and applications (e.g., shopping cart robots [19], exoskeletons [10, 17]) to help participants move beyond humanoid concepts.
Re-imagine & re-draw machine	Participants re-envisioned their machine as a robot. They also named the robot.
Gemini robot image	Selected worksheet responses were entered into a Google Form, exported, and processed via the Gemini API [22] to generate robot images; prompts were refined in a second run to ensure multiethnic representation, reflecting the participants' backgrounds as members of underrepresented groups in STEM. At the workshop's close, participants reflected on their experience and attitudes toward robots. (See supplementary material for full Gemini Prompt.)
Workshop feedback	Participants gave written feedback on the overall workshop.
Career talk & robot lab tour	Roboticists gave participants a tour of a lab and talked about their respective careers and how they got there.
Post-workshop	A follow-up survey collecting reactions to the Gemini-generated images was administered via email a few days later.

Table 1: Structure of activities in the 3-hour workshop and the post-workshop activity

5.2 Robots as Environmental Stewards

Participants imagined robots that cared for shared outdoor and community spaces, such as parks and public areas. These robots addressed problems participants noticed in their everyday environments, including litter, uncomfortable public benches, and a lack of aesthetic appeal in buildings. Two key concepts emerged in this theme. First, participants designed a robot concept—*Bapti*—an autonomous robot that picks up trash and helps maintain buildings. Participants described *Bapti* as a "box with wheels" or a "human-like robot" with a friendly, smiling appearance. In addition to cleaning, *Bapti* could repaint or polish buildings, changing the colors to make them "look nicer," as explained by a participant: *"We thought that this robot could pick up trash around the school. Or just re-polish things. Maybe they could repaint, the robot could repaint."* This design reflected values of care, pride, and community responsibility. The second robot concept, *DigitalBench AI*, redesigns park benches to make them more comfortable. Participants further described this robot as having a dual function: in addition to improving benches, it would act as a guide, answering visitors' questions about the park and allowing people to report faulty benches. *"There's gaps in between the benches, which could probably be kind of uncomfortable to others . . . if they changed it to a more comfortable design, then probably more people would use it."* In this context, robots were viewed as helpers or environmental stewards that take on dirty or repetitive work, allowing communities to enjoy cleaner, safer, and more colorful environments.

5.3 Robots as Educational Support Systems

Participants described challenges such as stressful studying, limited access to books, and traditional teaching methods that felt repetitive or uninteresting. They therefore imagined robots that support learning by removing boring or stressful parts of education,

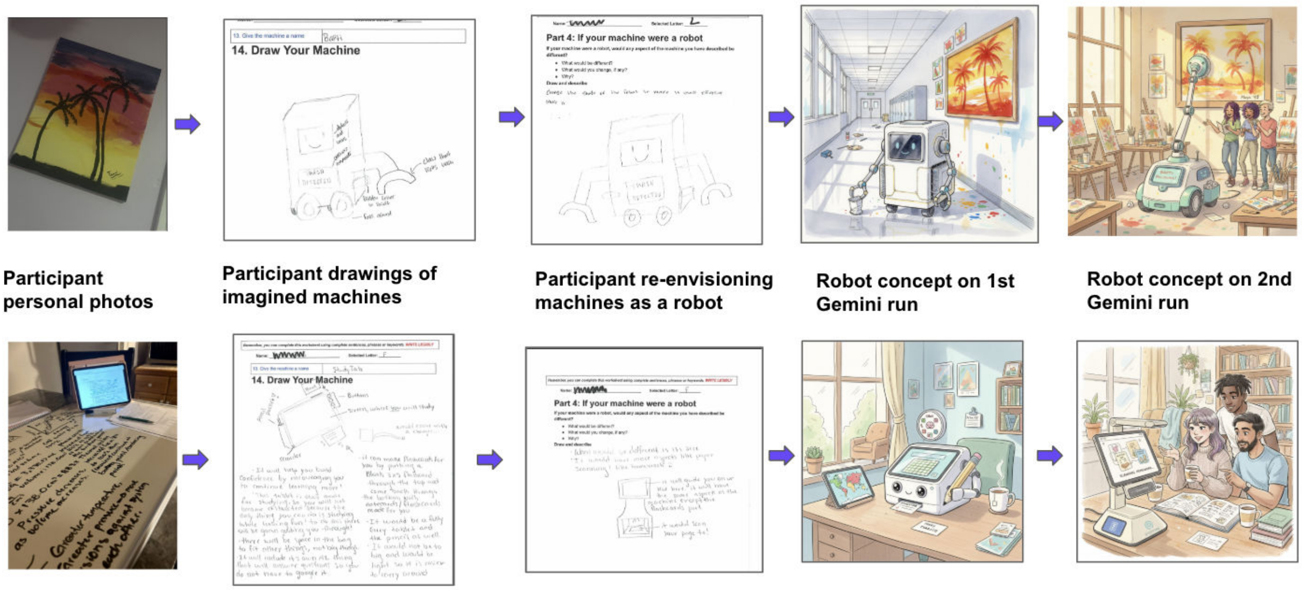

Figure 2: L-R (1) Participants' photo used for workshop, (2) Participants' drawing of a machine to solve their identified problem, (3) Participant re-envisioning machine as a robot, (4) Gemini-generated image first run, (5) Gemini generated image second run.

making learning more engaging. The first robot concept, *Tavoletta di Lettura* (Reading Tablet), combines physical books with digital features to encourage reading. Participants expressed concerns that the culture of reading was dying and stressed that people need to be encouraged to value the physical experience of books while also having the convenience of digital tools. This design suggests the importance of comfort, accessibility, and enjoyment in reading. It provides accessible options for everyone who wants to read digitally or physically: *"So, what if we have a thing next to the screen [Tavoletta di Lettura] that has Braille on it? Or, there could also be a button if you want to hear your sample read out loud."* A second concept, *Book Vendor*, is a robot that connects to the entire library, retrieving requested books for readers, reducing the time spent searching through shelves and allowing users easy access to books. *"The main problem with the library is finding a book. I want to make a vending machine [robot] but for books… in the front of the library you can type a book you want and… it'll fall… go through a chute and then you can grab the book."* Across these designs, participants expressed a strong desire for education that is personalized and stress-free. Some participants raised concerns about bias and misinformation in artificial intelligence systems. This showed that children not only imagine helpful learning technologies but are also critically aware of the risks and limitations of these technologies.

5.4 Robots as Well-being Enforcers

Participants described struggling with excessive screen time and online gaming, and neglecting to take breaks to move their bodies. They felt a need to limit screen use because they perceived themselves as becoming addicted to screens. A single robot concept emerged, the *ScreenLock400*, a locking system that covers the computer or keyboard once a preset time limit was reached. Screen time is tracks through a wearable watch, which the user wears while using the computer. The participant group described it as *"when it [the robot] senses that there's too much screen time, it'll mount, it'll engage the machine. We should also have a tracker on us so it knows we leave the vicinity. So, when the machine senses too much screen time."* This design indicated that participants valued well-being and were willing to relinquish control to protect themselves. They wanted robots to enforce limits only for screen use and not take control of other parts of their lives. This feature highlights the tension between support and autonomy. Robots were seen as assistants with limited authority, reflecting participants' desire for external discipline while maintaining personal agency. Future research could consider how the enforcer role balances discipline and agency–specifically, how robots in this capacity communicate expectations, negotiate conflict, and avoid becoming overly controlling.

6 Participant Responses to Gemini-Generated Images

Survey responses to Gemini-generated robot images were collected from workshop participants who shared their perceptions of the generated images. Questions asked in the survey included: *What do you like about the generated robot image? What do you dislike about the generated robot image?* Full survey questions can be found in the **supplementary material**. We found participants' reactions to be mixed and reflective, confirming they saw images not as final designs or solutions, but as interpretations inviting response and critique. Some participants' first reactions often expressed surprise, curiosity, and excitement: *"I was excited to see how it turned out,"* and were often short, usually expressing uncertainty or neutrality (e.g., *"Meh," "Surprised,"* and *"Confused but intrigued"*). Several participants noted accuracy, stating *"It looked very close to what I* *imagined"* and *"It captured the idea pretty accurately."* Others focused on aesthetic or expressive qualities, such as *"It's silly," "It's cute and funny,"* and *"I like the shape and the little details."* Others pointed to missing elements or mismatches, saying *"It didn't include everything I wrote"* or *"Not exactly what I was expecting."* Participant responses reinforce the potential use of AI-generated images as intermediate artifacts for children's ideation, confirming prior work that uses AI-generated images as prompts for reflection and revision across the design process [23].

7 Discussion

7.1 Value Conflicts and Ongoing Negotiations

Across the findings, children did not imagine robots as tools that simply make life easier. Instead, robots were placed within emotionally meaningful practices such as hobbies, learning, family routines, and digital play. Participants' designs reflect ongoing negotiations about when robots should help, when they should step back, and what should remain human–a tension that is clear in hobby-related robots such as *Breadmaker3000.* While the robot supported learning a cooking technique, bread-making itself was valued as shared time with family. Participants wanted robots to reduce frustration or physical effort, to step in when the parent was not available to bake, but without removing the creativity, care, or emotional connection involved in bread making. In this way, effort was not exclusively seen as a problem to eliminate, but rather as part of what made the activity meaningful. Examples like this raise an important design question: How can robots support children's needs without removing the joy, effort, or connection embedded in everyday practices? For child-centric robot design, these negotiations highlight the need for value-sensitive approaches that respect emotional meaning, preserve balance, and treat robots as participants in ongoing value negotiations rather than simple problem-solvers.

7.2 Agency and Control Versus Functionality

Participants expressed desire for limited and task-specific robot agency. Robots were expected to act only within clearly defined boundaries, especially in enforcement roles such as managing screen time. Well-being robots were allowed to restrict access to devices, but only for that single purpose. Participants were clear that robots should not make decisions beyond the task they were designed for. This assertion reflects a careful negotiation between wanting support and maintaining personal agency and control. This tension resonates with the tradeoff between functionality and overreach highlighted in Glawe et al. [15]. While participants valued robots that could take decisive action, they also resisted designs that removed too much autonomy. Even when participants described interactions as "hostile but necessary," they still wanted the ability to understand, anticipate, and limit what the robot could do.

7.3 Awareness of Risk and Concerns

Participants also showed awareness of risks associated with their robot designs. In the educational theme, some participants raised concerns about informational accuracy, questioning whether robots could provide fair or accurate guidance without bias and misinformation. This reflects a critical understanding that robots may shape knowledge and learning in ways that are not always neutral. In addition, participants discussed issues of accessibility and dependence. Some participants emphasized the need for educational robots to support access to learning resources, especially when books or help are not readily available. At the same time, they worried about becoming too reliant on automated systems. These concerns point to an understanding that robots can both support and limit growth. Together, these insights suggest that children are not passive recipients of technology. Instead, they actively consider tradeoffs between support, fairness, access, and independence when imagining robots in their everyday lives. As researchers, we acknowledge that the role of Generative AI model output as a reflection artifact can bias the ways in which children perceive and imagine what a robot can do, and what a robot may look like. This may end up exerting more influence over children's imaginative process than expected. Properly framing the use of Generative AI output either as a reflexive or visualizing tool can help minimize unexpected outcomes [26].

8 Conclusion and Future Work

In this paper, we examined how children imagine robots as part of their everyday lives using a participatory design workshop leveraging photos as probes and Generative AI outputs as artifacts for reflection. Participants designed robots that reflected what they value in their everyday lives and environments. Participants imagined robots' roles as partners that support meaningful activities while maintaining joy, effort, and human connection. Across the different roles assigned to robots, participants described ongoing negotiations around agency and control. Gemini outputs can be understood as AI interpretations rather than direct reflections of participants' ideas. Therefore, these outputs could serve as artifacts for future work and follow-up elicitation. Our findings are situated within a specific demographic and community context, focusing on high school adolescents. Accordingly, our work does not seek broad generalizability, but rather aims to provide contextually grounded insights into how young people envision robots in their everyday lives. The methodology presented here offers potential for adaptation in future research across diverse age groups and communities, while emphasizing the importance of ensuring reciprocal value for participating communities beyond their role in the study.

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