Working Together Toward *ikigai*:

Co-designing robots that can help us achieve meaning and purpose in life

Robots are commonly envisioned as assisting older adults in physical tasks or providing companionship. But there has been less focus on helping older adults achieve more intangible, but equally important, aspects of wellness, such as a feeling of purpose and meaning in life. Here, we share our experiences working and learning together with older adults on developing a robot that can support their achievement of ikigai—meaning or purpose in life.

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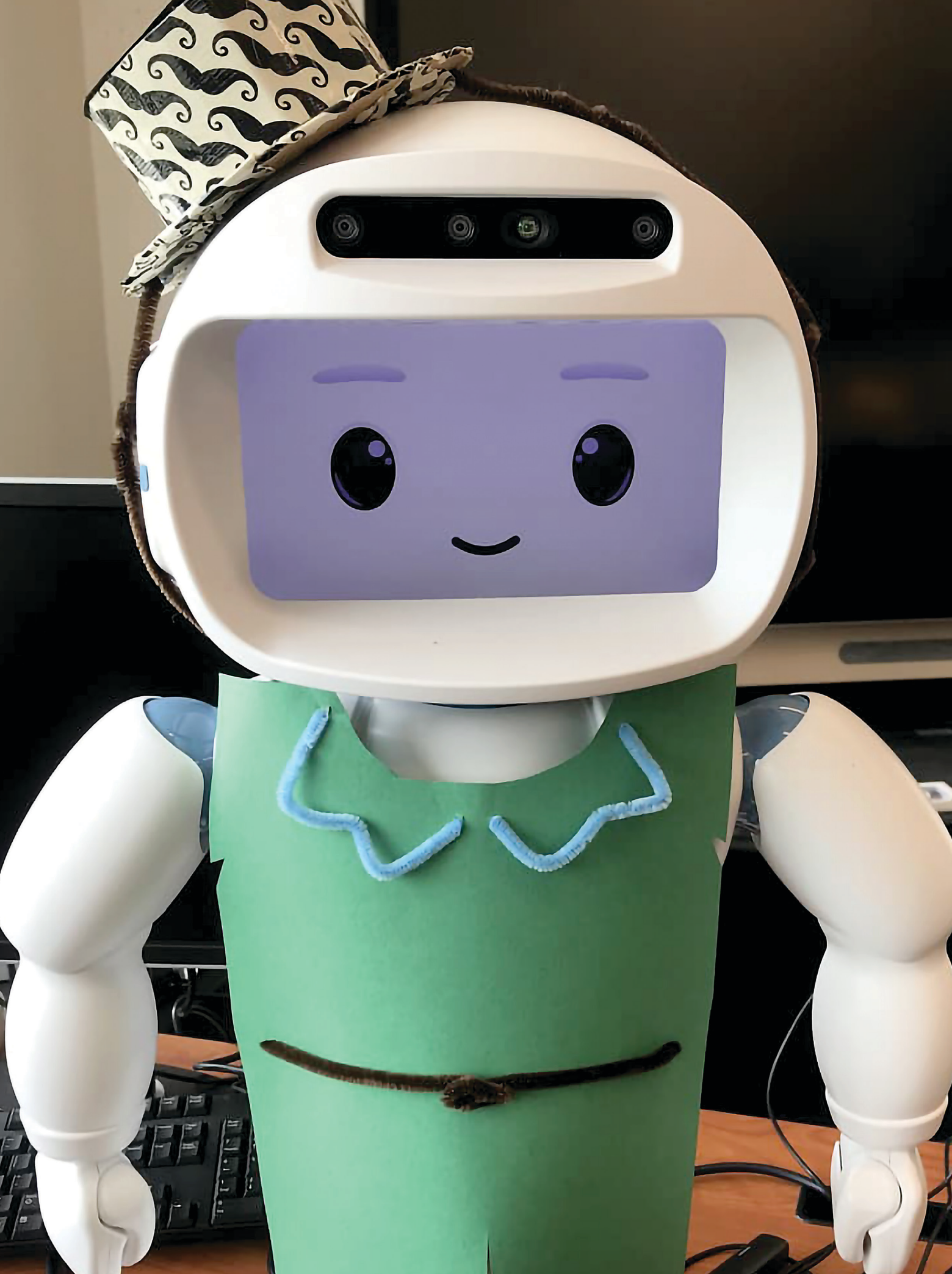
"What is the meaning of life?" "What makes your life meaningful?" These questions would stump, and yet also be relevant to, almost anyone. How could a social robot start to discuss such topics with people, particularly with older adults who may not be very familiar or comfortable with robots? Over the past two years, our research team has been exploring these questions through a collaborative project between Indiana University Bloomington and the Toyota Research Institute. Our main aim is to develop I.R.I.S. (Interactive Robot for Ikigai Support) as a tool that can help older adults reflect on, maintain, and improve their sense of purpose and meaning in life, known as *ikigai* in Japanese, as they age.

Aging often brings with it a series of life changes, which can include retiring from a life-long job, children moving away, changes in health status and physical and cognitive abilities, or shifts in one's social circle as friends leave or pass away. These changes can affect activities and relationships that people find meaningful in their lives. In Japan, the government recognizes the maintenance of ikigai as a significant component of successful aging and has developed policies to support older adults in their pursuit of ikigai in later life. Our work is inspired by research on ikigai as an important aspect of well-ness, as well as the Toyota Research Institute's exploration of using robotic technologies to support ikigai.

WHAT IS *IKIGAI*?

"What can be said from the beginning, without having to bother with research, is the fact that there is nothing more necessary than ikigai for human beings to live vigorously."—Notes psychiatrist

Image by Courtesy of IRIS Indiana University Bloomington



Mieko Kamiya, the "mother" of ikigai psychology.

The Japanese term "ikigai" loosely translates as one's sense of meaning in life. It is commonly understood as essential for individuals to lead a fulfilling life in Japan. Ikigai is often associated with various health benefits, such as prolonged health, longevity, and positive effects on well-being. In recognition of these benefits, the Japanese government incorporates the promotion of ikigai in its policy-making, with older adults as the main target. Senior Citizens Clubs, local ikigai centers, and ikigai employment programs, for example, were established in response to the government's focus.

In Japan, ikigai as a wellness concept became highly popularized in the 1960s. In recent years, it has attracted international audiences. One of the authors learned about the term from a book her mother in Bosnia was reading. Dr. Akihiro Hasegawa, a leading researcher in ikigai, calls the period from the 2000s onwards the "renaissance of ikigai" [1].

Inspired by the potential benefits of ikigai for older adults, our project aims to explore how we can use a social robot to support a sense of ikigai in the lives of older adults in the U.S. and Japan. Throughout the project, we have been working closely with various groups of older adults to learn about their experiences of ikigai and understand their preferences regarding how they might want to use a robot like I.R.I.S. in their daily lives.

CREATING SOCIAL ROBOTS TO ASSIST OLDER ADULTS

Various robot designs cater to older adults, aiming to enhance their health and well-being. Paro, a baby seal-like robot, is employed in nursing homes to provide emotional support and foster social connections in Japan and the U.S. Affordable Joy-For-All cat and dog-like robots offer similar benefits and are readily available in U.S. pharmacy stores. Moreover, popular robot voice agents like Alexa serve as personal assistants and companions for older adults. For example, ElliQ, a robot that looks like a lamp and can engage older adults in conversation and connect them with others, has been distributed to older adults in New York with the goal of reducing loneliness and social isolation [2].

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To design user-centric robots for well-being, researchers commonly adopt a human-centered approach similar to the "double diamond" method proposed by the UK Design Council [3]. This method encompasses four stages: discover, define, develop, and deliver. Discover aids in understanding the problem, define involves analyzing insights from the discover phase, develop entails generating multiple solutions and engaging in co-design with potential users, while deliver focuses on testing the prototype design.

The creation of I.R.I.S. followed the previously mentioned steps. To gather ample feedback on the complex topic of ikigai, we expanded our "co-design" process throughout the four stages of the robot's development (see Figure 1). By co-design, we mean working closely with older adults in ways that allow us to mutually benefit from this process. Our co-design approach provided valuable insights for creating behaviors and activities for our ikigai robot, but also offered a meaningful opportunity for researchers and participants to reflect on their own ikigai. We invite readers to join us on this design journey.

DISCOVER AND ANALYSIS: FINDING OLDER ADULTS' IKIGAI

How older adults define their ikigai. The first step in the design process is to understand the user. For us, it means to understand "what is ikigai." Despite the growing global recognition of the concept, translating ikigai for cross-cultural understanding is a challenging task. There is no direct English translation of the term, and researchers from different backgrounds provide various nuanced interpretations, such as self-realization, a sense of purpose and/or meaning in life, and joy and happiness in daily life.

Retirement, financial instability, children leaving the nest, a decline in physical health, and loss of spouses were often cited as risk factors that can lead to a loss in ikigai.

To get a grasp of this seemingly elusive concept and see how different older adults define and value their own ikigai, we started our project by asking older adults, both in the U.S. and Japan, how they defined their ikigai in a series of surveys and interviews. We used a combination of K-1 and ikigai-9 scales from Japan and other well-being scales used in the West [4, 5].

Our findings from 100 survey responses and 37 in-depth interviews with the American and Japanese older adults [6] revealed their ikigai encompasses a rich fabric of emotions, including: a sense of joy, happiness, and a sense of accomplishment and fulfillment, which confirmed what we learned from the previous literature.

We also discovered their sense of ikigai varied depending on a number of factors in their lives: whether they lived alone or with family members, their feeling of financial security, and their social participation level. Findings from these surveys and interviews showed how ikigai acts on various social levels: personal, within close-knit relationships, and in the larger community.

These insights also sparked some design recommendations that older adults thought appropriate for using robots for ikigai enrichment: robots

nudging users to reflect on their daily ikigai experiences, urging users to call family members and friends they care about, suggesting new hobbies and activities older adults can embark on, or reminding older adults to engage in activities they know and enjoy.

Seeing ikigai in photographs. Once we had gained an understanding of the primary sources of ikigai through our surveys and conversations with older adults, our attention turned to delving deeper into the personal experiences of older adults and their ikigai. Photographs serve as a valuable medium for capturing meaningful events and people in our lives and as a powerful tool that allows us to revisit and relive those cherished moments.

To gain a deeper understanding of their individual ikigai, we invited both groups of older adults to select and share 10 photographs that represent things, people, or events that hold personal significance.

These photos were then used as the basis for revealing conversations on how they felt when they took the photos, what was important about the photos for them, and also to understand the various types of experiences that older adults see as important and meaningful.

For instance, one participant had multiple photographs of various scenes from Indiana University, where she used to work, hanging in her room (see Figure 2). As she narrated her experiences of introducing the campus to new students, the occasional moments when she met with her famous coach or basketball player colleagues, her eyes sparkled with enthusiasm as she smiled. In that moment, the participant had a satisfying reminiscence that seemed to be part of her meaningful experience at the university.

Hence, we recognized this activity could be a meaningful way in which I.R.I.S. can potentially support their sense of ikigai through recollection and at the same time, to allow I.R.I.S. to get to know older adults better.

Learning more about ikigai from ikigai experts. To better understand the current landscape of ikigai promotion in Japan and the efforts made by various contributors, we also conducted interviews and co-designed workshops with "ikigai experts" who formally support older adults' ikigai, including municipal organizations, academics, and "older adult leaders" in the community [7]. For example, we spoke with employees from local community centers and ikigai information centers run by local governments as well as leadership from the Hyogo Senior Citizen's College—established in 1969, it is the first university created exclusively for senior citizens. Our aim was to tap into their insights and knowledge, allowing us to incorporate their perspectives in our discovery stage.

Prior to the interview and co-design studies, we made an intensive effort to familiarize ourselves with their practices; for example, we trained ourselves using a textbook

Figure 1. The double diamond method of the co-design process on creating I.R.I.S. adapted from the UK Design Council [3]. The human-robot figure is depicted on the right. ©Cheryl Fong.

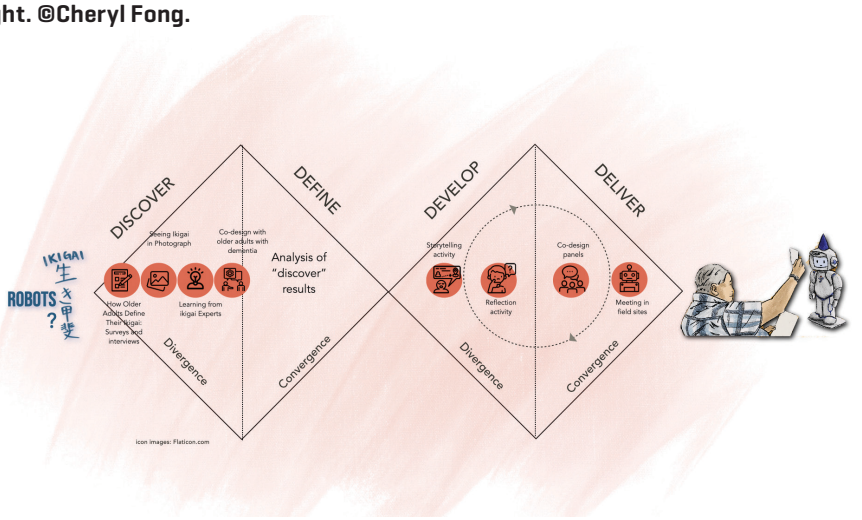

Figure 2. A picture of the university that a participant shared with us, reminiscing on her good days when she worked at the university.

used by "ikigai advisors" (kenkou-ikigai dukuri advisors). This immersive approach allowed us to speak their language when communicating with experts, facilitating a fruitful discussion to exchange their lived knowledge of ikigai support and transfer it to robotic applications.

Experts unanimously agreed ikigai could be unique to each person, while also sharing emerging themes that can contribute to ikigai, both positive and negative. Retirement, financial instability, children leaving the nest, a decline in physical health, and loss of spouses were often cited as risk factors that can lead to a loss in ikigai. Promoting older adults' social participation, being a listening partner, providing opportunities for self-improvement and learning, fostering family ties, helping older adults get involved in community events by providing relevant information, and including children and grandchildren were discussed by experts as some of the promising ways in which I.R.I.S. could support older adults' ikigai.

Experts enjoyed learning about the current state of robotic technology from us and were enthusiastic about using social robots like I.R.I.S. to enrich older adults' lives. They asked us about the capabilities and functions of robots like I.R.I.S. They shared thoughts on artificial intelligence and robots and their place in society, as well as their visions of how they would use I.R.I.S. if it was in their homes. Given our rapidly aging society, "robots like this [I.R.I.S.] are necessary, not luxurious," said one ikigai advisor.

It was also hugely inspiring for us to learn from experts, many of whom are older adults themselves, about their passionate ways of navigating their old age. They engage in a wide array of social activities and continuous education while also assisting other older adults in achieving their ikigai.

Moreover, many ikigai experts who participated in the study were curious about how ikigai is perceived outside Japan. They were all intrigued and excited to hear how the concept has transcended boundaries, leading to diverse individuals from different backgrounds participating in meaningful discussions.

Ikigai is often associated with various health benefits, such as prolonged health, longevity, and positive effects on well-being.

Designing the robot's capabilities. After understanding older adults' ikigai more clearly, we focused on developing robot capabilities to support their sense of purpose. We collaborated with Jan Bays, the director of program development and education at Jill's House in Bloomington, IN, to design comfortable robot workshops for our older adult participants. Using the Eden Alternative's well-being framework [8], which seeks to ensure older adults experience identity, connectedness, security, and autonomy, we identified participants as experts of their own needs, fostered connections with the researcher and the robot, created a sense of security by involving familiar faces, and promoted autonomy by providing choices for different robot elements.

This co-design process offered older adults an enjoyable activity and a sense of research involvement outside their usual routines. Participants developed long-term interactions with I.R.I.S., integrating the robot into their social circles and adapting their interactions to align with the robot's capabilities. Their engagement went beyond the workshop, with participants discussing the robot outside of the activity. One participant even adorned the robot with a sticker given to her by her grandson (see Figure 4).

The co-design process provided us with invaluable insights into robot capabilities. For example, we learned it is important to personalize I.R.I.S. to meet the unique needs of individual users, including understanding the

things that capture their attention and hold meaning in their lives. The strong connection we formed with the community motivated us to do our best in promoting their ikigai.

DEVELOP: CREATING ACTIVITIES FOR I.R.I.S. AND CO-DESIGN WITH OLDER ADULTS

After learning from and exploring the ikigai concept, we condensed and translated our main discoveries into different interaction ideas. We designed two activities for I.R.I.S., aiming to improve older adults' meaning and purpose in life.

The first was a story-telling activity inspired by our previously mentioned photo-elicitation study, where the robot provides visuals, like photographs of family and travel, and verbal prompts to encourage creative storytelling related to their meaning and purpose in life. The second was a reflection study encouraging older adults to reflect on and share their past, present, and future stories and visions and self-evaluate different aspects of their life that can lead to ikigai.

CONVENING AN OLDER ADULT CO-DESIGN PANEL

To ensure the activities were suitable for older adults, we conducted a set of panels where a diverse group of older adult "experts of their own need" provided iterative feedback bi-weekly or once a month. The participants engaged in various discussions, particularly for the storytelling activity, including introducing them to the robot, exploring their ikigai, recording gestures for conversations, and designing the robot's facial expressions.

The older adult experts suggested the robot should have complex responses when interacting with them. Instead of providing canned responses, the robot should offer more personalized responses. They also mentioned the robot's movements should be subtle, such as a subtle nodding when listening to someone's opinion, rather than big movements. Certain facial expressions and sounds, such as kissing sounds and faces, are not appropriate for the storytelling activity.

The panel sessions also fostered

Figure 3. Older adults experiencing an exercise activity led by I.R.I.S. at a local community center in Japan.

Figure 4. Participant building a connection with the robot by handling the robot a sticker.

Figure 5. Panelists and researchers smiling for a camera like the panel session was their ikigai.

a sense of community among the experts, who attended the sessions together with the same group of people. This recurring engagement allowed them to deepen their understanding of technology, robot design, and the intricacies of assembling different components—such as conversation, gestures, and faces—of the robot.

We also enjoyed connecting with them, especially when we shared laughs when the robot made mistakes (see Figure 5).

The strong connection we formed with the community motivated us to do our best in promoting their ikigai.

DELIVER: MEETING IN THE FIELD SITE

After iterating and getting regular feedback from the older adults, it was time to bring I.R.I.S. to the field sites (see Figure 6).

For the photograph activity conducted using the Wizard of Oz (WoZ) method, we analyzed how the participants interacted with the robot and discovered several improvements that need to be made with participants. Moreover, through the divergence of topics from a single picture, we realized the possibility of creating personalized prompts and images based on an individual's ikigai.

Aside from this, participants also shared stories that were very important to them. "Every time I told the story, which was not very many times, two or three. I always felt all this deeply, not that I flutter or act hysterical," one participant told the researcher after reminiscing on her own drowning experience while looking at a photo of a boy in a boat.

During the reflection activity, the older adults sincerely responded by opening up to I.R.I.S. about their experiences—both highs and lows—lessons learned, and emotions they felt. Overall, participating older adults valued the interaction we designed for

Figure 6. I.R.I.S. and our team on the way to a field site in Japan. (Left) I.R.I.S. enjoying the view outside, (right) our team carrying I.R.I.S. on the metro.

Figure 7. Researchers showing off I.R.I.S. to the public and having one of our ikigai moments.

this activity, acknowledging the importance of considering where they are in their life.

We also found it captivating how older adults embraced I.R.I.S.'s inherent quirkiness and imperfections in an emotionally engaging way, often giving words of encouragement and comfort when it stumbled. As the activity progressed, older adults adjusted their timing of speech and pace to accommodate I.R.I.S.'s (imperfect) way of talking, scaffolding sweet interactions just like two new friends getting to know each other.

This set of field studies is only the first iteration of multiple we plan to do to create our final design.

CONCLUSION: FUTURE OF CO-DESIGN WITH I.R.I.S.

Developing I.R.I.S. has been an incredible journey of exploring the promotion of ikigai and supporting the well-being of older individuals. By following the double-diamond process, collaborating with older adult users, and bonding with our local community, we have gained insights to improve I.R.I.S., refine our research methods, and aim to make a positive impact on their lives. Our future goals include refining I.R.I.S.'s capabilities, continuing with expert panelists, and bringing I.R.I.S. to real homes. Through this research, our team has discovered our own ikigai by appreciating the beauty of individuals' lives. The connections we have made give us a sense of purpose and motivation—"a thing that gets us up in the morning" [9] (see Figure 7).

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Biographies

Long-Jing Hsu is a Ph.D. student in the informatics program at Indiana University Bloomington (IUB), specializing in human-computer interaction. Her research centers around the co-design of robots with older adults and their caregivers. Her ikigai is a combination of research, laughter, and the random Christmas dance with her older adult friends/participants.

Waki Kamino is a research assistant and a former master's student at IUB, and a current Ph.D. student in information science at Cornell University. Her research focuses on the cross-cultural studies of human-robot interaction, focusing on Japanese robotics. She plans to attend a senior citizen's college when she is older for her future ikigai.

Weslie Khoo is a USDA-NIFA postdoctoral fellow. He is interested in utilizing AI and design thinking to improve public health and personal well-being. Khoo's current ikigai is being present and being there for others, especially over a cup of delicious boba.

Katherine Tsui co-leads the Robotics User Experience and Interaction Design team at Toyota Research Institute as the Manager of Human-Robot Interaction. Her research focuses on supporting aging older adults in the U.S. and Japan, specifically with respect to physical stability and mobility in their own homes and also with social isolation and loneliness. Tsui's ikigai is teaching and mentoring aspiring researchers and spending time observing wildlife and nature while hiking.

David Crandall is Luddy Professor of Computer Science at IUB. His research focuses on computer vision—designing algorithms that enable computers to "see"—as well as machine learning and artificial intelligence more generally. In addition to his professional pursuits, Crandall finds his ikigai in cycling, swimming, playing piano, traveling, spending time with his birds, and trying to learn new skills (even though he usually fails).

Selma Šabanović is a professor of informatics and cognitive science at IUB. She studies the design, use, and consequences of socially interactive and assistive robots in different cultural contexts and application domains. She finds her ikigai in doing things together with her family, friends, and students, in trying out new recipes, and the small daily joys of life.