




Designing user-centered policy for social robotics: policy analysis and consultation with the aging and dementia community

Jill A. Dosso, Susanna E. Martin, Haiger Ye, Gabriella K. Guerra, Anna Riminchan & Julie M. Robillard


To cite this article: Jill A. Dosso, Susanna E. Martin, Haiger Ye, Gabriella K. Guerra, Anna Riminchan & Julie M. Robillard (2025) Designing user-centered policy for social robotics: policy analysis and consultation with the aging and dementia community, *Disability and Rehabilitation: Assistive Technology*, 20:6, 1687-1699, DOI: [10.1080/17483107.2025.2471050](https://doi.org/10.1080/17483107.2025.2471050)


To link to this article: <https://doi.org/10.1080/17483107.2025.2471050>

 View supplementary material [↗](#)

 Published online: 05 Mar 2025.

 Submit your article to this journal [↗](#)

 Article views: 304

 View related articles [↗](#)

 View Crossmark data [↗](#)

 Citing articles: 1 View citing articles [↗](#)

RESEARCH ARTICLE



Designing user-centered policy for social robotics: policy analysis and consultation with the aging and dementia community

Jill A. Dosso^{a,b}, Susanna E. Martin^{a,b}, Haiger Ye^{a,b}, Gabriella K. Guerra^{a,b}, Anna Riminchan^{a,b} and Julie M. Robillard^{a,b}

^aDepartment of Medicine, Division of Neurology, The University of British Columbia, Vancouver, Canada; ^bBritish Columbia Children & Women's Hospital, Vancouver, Canada

ABSTRACT

Purpose: Social robots are a promising assistive technology to support older adults in home and healthcare environments. Engaging end-users in all stages of social robot research, development, and deployment is critical to adoption. However, the voices of end-users are missing from policies about social robots. This work consults with end-users of social robots to capture their perspectives on social robot policies and co-create expert-driven policy recommendations to guide the future implementation of social robots for aging.

Materials and Methods: In this two-part study, we performed a content analysis of $n=47$ international policies on social robotics followed by seventeen semi-structured interviews with experts on aging and dementia from both professional ($n=6$) and lived experience ($n=11$) perspectives to capture their opinions about social robot policies.

Results: Our analysis highlights alignments between social robot policy recommendations and perspectives of the dementia community including upholding respect for human rights and dignity, the need for clear and consistent regulation, and the need for public engagement. Participants further recommended that policies should prioritize cost and accessibility considerations and focus on aging- and dementia-specific considerations. Participants reported that the responsibility for social robot policy development lay primarily with governments and the healthcare sector. Increased consultation with end-users, minority groups and medical professionals was suggested for future policy development.

Conclusion: Findings contribute to the ethical co-creation of social robots as assistive technologies for older adults and provide actionable steps for the development of policies that reflect the values and perspectives of end-users.

ARTICLE HISTORY

Received 12 April 2024
Revised 14 February 2025
Accepted 18 February 2025

KEYWORDS

Social robot; dementia; assistive technology; aging; policy analysis; co-creation; stakeholder engagement

> IMPLICATIONS FOR REHABILITATION

1. Social robots are promising assistive devices for older adults and persons living with dementia, including in cognitive rehabilitation contexts, but there is a lack of clear, consistent regulation in how these devices should be designed and used.
2. Older adults and aging and dementia experts are eager to participate in robot co-design as it relates to rehabilitation. There is an ethical imperative to engage these and other end-user groups in the development of robots and robot policy.
3. Current social robotics policies focus on challenges to adoption and ethical issues such as discrimination, bias, deception, inequality, and liability. Persons with lived experiences of dementia and professional experts point out policy gaps around cost and access, the involvement of minority groups and end-users in policymaking, a lack of standardization, and a lack of aging- and dementia-specific considerations.
4. There is rapid development happening at the intersection of social robotics and rehabilitation; and while the policy landscape is not yet equipped to manage these emerging issues, empirical evidence such as the findings in this paper can support next steps in this area.

Introduction

Effective and value-aligned assistive technologies are needed to support older adults in sustaining a high quality of life. Assistive technologies can help users to manage health conditions, support functional independence, and improve wellbeing. As such, assistive technologies have multiple purposes, functions and form factors,

ranging from mobility and sensory aids to digital technologies like apps or telehealth services [1]. The demand for assistive technologies that meet the needs of older adults is likely to increase in the coming decades; the proportion of the population above the age of sixty-five in the US and Canada is increasing, with a projected doubling of the demand for elder care by 2031 and a tripling of Canada's over-85 population by 2050 [2,3]. Older adults'

priorities when selecting an assistive technology include reliability and ease of maintenance, accessibility and affordability, and ease of use [4]. An assistive device must be well-aligned with a user's identity, goals, and expectations for successful adoption and continued use [5–9]. Among the most recent developments in assistive technologies for older adults are social robots.

Social robots (also socially assistive robots) are devices capable of engaging a user in an interaction and acting on the physical environment through effectors. They can be designed in a variety of forms including humanoid (e.g., Pepper [10]), pet-like (e.g., Paro [11]; MiRo [12]), or avatar-based [12], and are capable of interacting with people using a variety of verbal and non-verbal cues. A defining feature of social robots, which sets them apart from other interactive technologies (i.e., Siri [13] or Alexa [14]) is their physical presence. Social robots are embodied, socially situated technologies. Their embodied presence does not however mean they are care-bots; robots that have been popularised in Japanese healthcare settings providing physical assistance with manual care tasks such as patient handling, feeding and toileting [15]. Social robots are primarily interactive and are increasingly being designed with advanced capabilities and software features. The recent rise of artificial intelligence promises new functionalities and applications for social robots, such as combining data from movement and audio sensors, with natural language processing to interpret dialogue and generate personalized, socially adept responses [16,17]. The popularity of social robots is growing, with commercial sales of robots expected to reach 65 million robots and 19 billion dollars by 2025 [18]. The market for social robots for older adults specifically saw a rapid acceleration in response to the COVID-19 pandemic as they offered a solution to the paradox of reducing human contact without reducing social connectedness. As one example, the state of New York distributed 800 social robots to older adults as a means to reduce loneliness and isolation [19].

A growing body of literature demonstrates the tremendous potential for social robots as assistive devices that support older adults to live well. Applications include providing engagement and companionship, assisting individuals with physical and cognitive impairments, facilitating independent living, and monitoring health [20–24]. Among the most widely studied applications, companion and telepresence social robots show promising evidence of effectiveness in decreasing loneliness, improving blood pressure and pulse rate, and supporting pain management and adherence to a medication schedule [24–28]. Social robots can facilitate conversation and promote engagement within a group, making them especially applicable to older adults searching for social connections in group settings such as long-term care [29]. Persons with lived experiences of dementia, as well as their care partners, are identified as a group that may particularly benefit from social robotics [30–32]. In small studies, robotic pets have demonstrated effects among users living with dementia including a decreased need for pharmacological treatment, increased social interactions, and reduced loneliness and agitation [33–36]. Aged care has become a central focus of social robot applications [37].

However, social robot adoption to date has faced practical barriers. The research space is characterized by studies of only moderate methodological quality [32,38]. Social robots are not acceptable to all potential users, and their performance is not always superior to control items like non-robotic toys [39,40]. Creating a device that can correctly perceive and react to a user's emotional state is technically difficult, and it is frequently reported that currently available social robots underperform relative to the user's expectations [6,7,41–45]. This limits the current understanding of how users might perceive social robots if their use was more widespread with consistent, high-quality device performance.

Designing a device that is intended to form a social and emotional relationship with a user also raises several ethical questions [46,47]. Negative emotional responses, such as anger or irritation, can be elicited when an older adult has forgotten or does not understand the purpose of a social robot in their environment [48]. Stigma can be associated with using a social robot, and older adults can report feeling infantilized or undignified when interacting with social robots because of their “toy-like” properties [7,48–50]. There are also concerns that the use of social robots may reduce a user's opportunities for human interactions, or compromise their privacy and autonomy [7,50–52].

Public discourse captures a range of sentiments about assistive robots. Despite the potential of social robots to positively benefit users, the development of legislation, policies, and equitable access programs for social robots is lagging behind the speed of technological innovation in the field of robotics [53]. A policy can be defined as a guide to action [54]. For this study, we adopt this definition in relation to collective action, or policies that propose actions be taken by more than one person i.e., governmental bodies, businesses or organizations. A jurisdictional scan reported that in Canada, assistive technology is not explicitly addressed in policies created by federal health or social services [55]. Provincial level policies are not consistent in their definition of assistive technology, and each province's variability in funding and coverage makes access to assistive technologies challenging. Canadian policies primarily focus on addressing assistive technologies for mobility, such as electric wheelchairs, and there is minimal policy guidance for assistive technologies like social robots, which address cognitive and mental health concerns [55]. Jurisdictional heterogeneity in policies is also reflected more broadly. Global initiatives such as those found in East Asian and Western European countries for example exhibit social, technical and regional differences that reflect the local priorities of social robot innovation [56].

Missing from the literature on social robots are expert and end-user opinions on social robot policy and recommendations for future policy development. The need to address this gap is highlighted by the diversity among policies as well as the wide range of attitudes and perceptions about using social robots as assistive technologies. Engaging partners in research and in the development of policies relevant to them can strengthen the result [57], and the United Nations Convention on the Rights of Persons with Disabilities states that disabled people should be able to be involved in decision-making that affects their lives [58]. This type of user engagement has been successfully carried out in the case of the Canadian National Autism Strategy and the Mental Health Strategy [59,60]. Dementia care is a key focus of social robot research [6,7,17,21,61–63]. People living with the experience of dementia, their care partners, and individuals working in a professional capacity in dementia services, represent a large target audience as end-users of social robot technologies. Therefore, the goal of the present work was to engage with the dementia community and analyze social robot policies from the perspectives of people with lived experience of dementia, their caregivers, and professionals working in dementia and aging, to identify actionable recommendations that improve policies in this space.

Materials and methods

Policy search

Database search strategy

We conducted a search for databases that contain social robot policies and then performed a search on those databases to identify relevant policies in April 2021 (Figure 1). The scope of the

project was limited to policies and policy recommendations published or endorsed by organizations who were member countries of the Global Partnership on Artificial Intelligence (GPAI) at the time of the search. We opted to focus on GPAI organizations to ensure that the policy sample was applicable to a Canadian research setting. The GPAI partnership is built on a shared

commitment to the Organisation for Economic Co-operation and Development (OECD) AI Principles which were the first set of international principles developed with the aim of responsible AI development [64,65]. The GPAI members are guided by their commitment to conduct research to understand the impacts of AI and encourage responsible development while mitigating and adapting

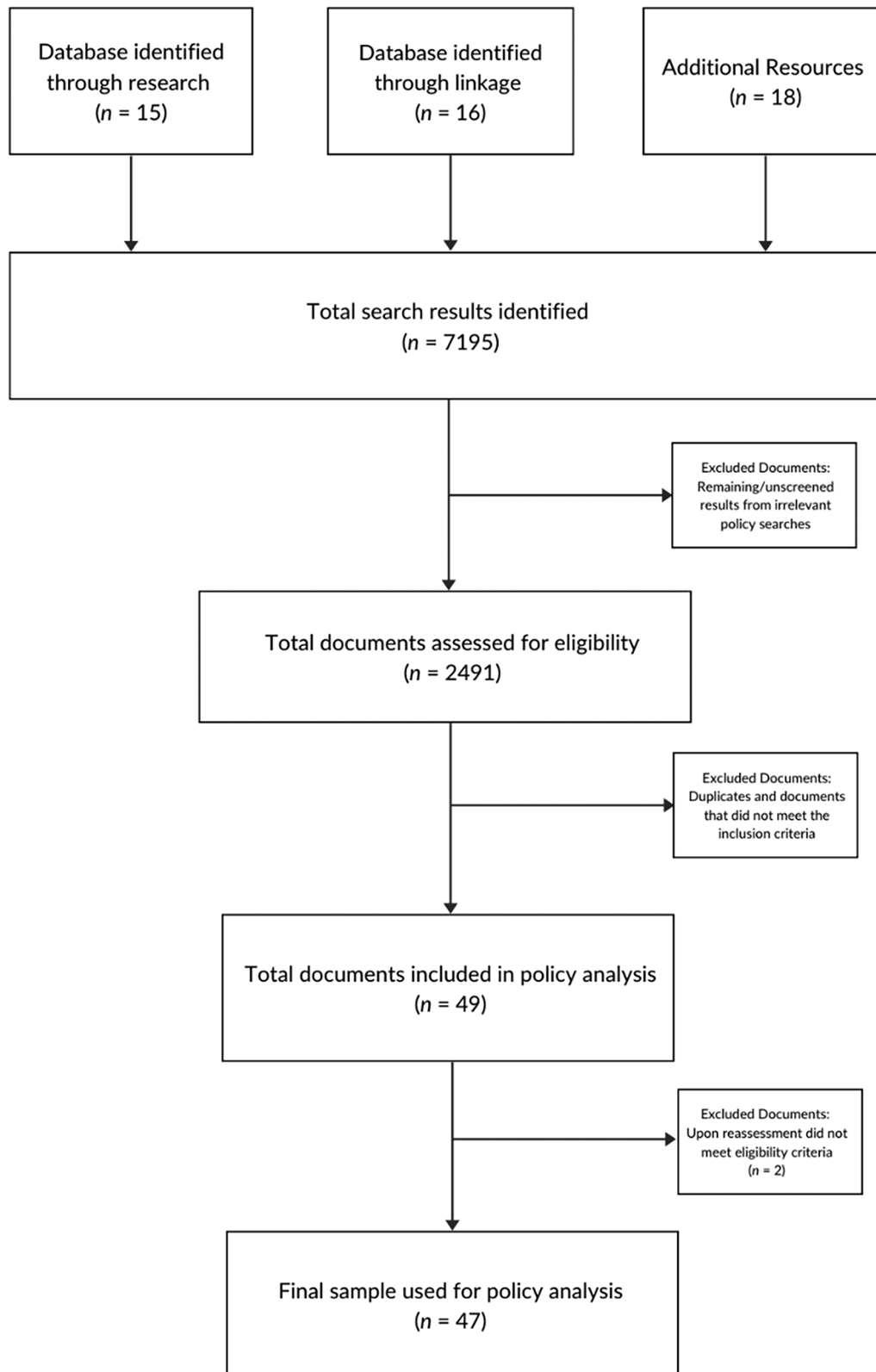


Figure 1. Method of identifying social robot policies for analysis.

to potential challenges to allow for trustworthy adoption of AI systems. The work of GPAI is grounded in principles of human rights, inclusion, diversity, innovation and economic growth [66].

Our database search was conducted on the University of British Columbia's Library and Google search engines, using the keywords 'policy', 'technology policy', 'robot policy', 'policy database', 'robot policy database', and 'technology policy database'. Additionally, the keywords 'robot' and 'technology' were searched in the University of British Columbia's Library search engine to identify any databases that may be relevant to the study but were not exclusively focused on policies. In parallel with this search strategy, a list of relevant social robot organizations was developed, and each organization's website was assessed for relevant content, publications, and databases.

Selection of policy sample

The identified website content, publications, and databases were screened based on the following criteria.

Inclusion criteria:

- One of "robot", "robo-", "robotics" must occur in either the title of the document, the title of a chapter or section, the policy statement, a definition of the area to which the policy applies, or an example of a place the policy can be applied to;
- Document must be developed by an organization located within a member country of the Global Partnership on Artificial Intelligence;
- Published in January 2010 to April 2021;
- Published in English.

Exclusion criteria:

- The term "robot" appears in the policy statement, but the policy does not apply to robots;
- The document is created by a corporation which sells robots;
- Organizations whose focus is on an irrelevant or non-social type of robot or system, such as drones, space robots, lethal weapons, sex robots, self-driving cars, unmanned aerial vehicles, agriculture and food systems robots, robotic process automation, surgical robots, and exoskeletons;
- Unofficial written documents such as blog posts, press releases, news articles, independent publishers, verbatim transcripts, and paid documents;
- Policies which only focus on financial investments in technology research, workforce, labour, employment, and economics;
- Documents with no official English translation.

The policy search yielded 7195 results. Removal of duplicates and application of inclusion/exclusion criteria led to a sample of 2491 documents which were assessed for eligibility. A total of 47 documents were included in the policy analysis (Figure 1. Full data set available on request).

Policy coding

Direct content analysis was applied to the policy sample, selected for its ability to extend knowledge and identify key concepts in qualitative data by using a combination of bottom-up and top-down processes [67]. An initial coding guide was developed using an iterative process of inductive and deductive analysis and carried out using Microsoft Excel. Initial codes were identified by reoccurrence of concepts and added to the guide as they emerged

from the policies alongside *a priori* codes that were informed by a preliminary literature review. Example codes included: 'robot benefits' i.e., 'emotional', 'cognitive' and 'social'; 'challenges to adoption' and 'public attitudes'; 'questions or concerns' about topics including 'human-robot-interaction', 'technological features', 'privacy and security'; and codes related to best practice recommendations including 'risk management' and 'governance'. The guide was refined and applied by two coders to a sample of policies ($n=5$). Codes were reviewed and discrepancies were resolved through discussions and iterative changes to the guide. Inter-rater reliability (IRR) was calculated in Excel for each round of subsample coding until an IRR of 94% was reached. The final coding guide was approved by both coders and applied to the full policy sample. As examples, the following policy segments were coded under the corresponding themes of 'ethical values of technology'; and 'discrimination' respectively: "Developers should respect human dignity and individual autonomy in the research and development of AI systems [and] take precautions to ensure that AI systems do not unduly infringe the value of humanity, based on the International Human Rights Law and the International Humanitarian Law" [68]; "Unfair bias must be avoided, as it could have multiple negative implications, from the marginalization of vulnerable groups to the exacerbation of prejudice and discrimination" [69].

Infographic development

Findings from the policy analysis (Table 1) were summarised in an infographic for use in the interviews (Supplemental online material). Briefly, the most salient sub-themes were extracted from the policy analysis. General themes that were not specific (such as a "general mention of accessibility" theme) were not included as they did not provide sufficient grounding for discussion. The purpose of the infographic was two-fold. First, to make the findings of the policy analysis readily available, in a quick, accessible format for wide dissemination, and second, to focus the discussions about policy analysis during the interviews. Participants were invited to share their thoughts and opinions on the findings displayed in the infographic, which had also been shared with participants ahead of the interview for them to review in their own time.

Table 1. Key themes and subthemes identified in policy analysis.

Analysis	Theme	Sub-theme	Frequency (%)		
Questions & concerns	Human-robot interaction	Discrimination	47		
		Bias	Bias	47	
			Deception	32	
			Attribution of liability	40	
		Liability & regulation	Insufficient regulation	36	
			Decision-making process	38	
		Economic costs	Economic inequality	36	
			Privacy & security	Data collection	32
		Challenges to adoption	Public attitudes	Lack of public trust	19
				Lack of alignment with cultural & social norms	19
Unfamiliarity	6				
Recommendations	Ethical values of technology & dignity	Respect for human rights	60		
		Multi-disciplinary collaboration	55		
		Ethical code of conduct	47		
		Standards	47		
		Policy review & development	47		
		Knowledge sharing	Public engagement	55	

Expert interviews

Participants and consent

The University of British Columbia's Behavioural Study Ethics Board granted ethics approval for this study (H21-01773). Recruitment was conducted *via* (1) social media and newsletter postings with affiliated organizations (including AGE-WELL NCE and Neuroethics Canada), (2) posters in community locations, (3) outreach *via* emails with study partner organizations, (4) posting on lab websites (including Neuroscience, Engagement and Smart Tech Lab), (5) posting on the health research participant recruitment platform REACH BC, and (6) through snowball sampling.

Eligible participants were English speaking and able to take part in a 45-min online interview over Zoom, and identified with at least one of the following categories; (1) living with experience of dementia, (2) current or former care partner of a person with lived experience of dementia, (3) implementer of social robot policy, *i.e.*, healthcare professional, (4) involved in social robot policy development, or (5) an advocate for persons with lived experience of dementia. Living with advanced cognitive impairment and fear of small pet-like characters were exclusion criteria. Interview participants were compensated with a \$25 gift card.

Seventeen participants were recruited for one-on-one interviews: two people with lived experiences of dementia, nine care partners of people with lived experiences of dementia, and six professional experts in the field of aging and dementia. Professional experts were three health researchers and three professionals working in older adult advocacy or education in the community. For participants living with experience of dementia, eligibility was determined by self-report; a formal diagnosis of dementia was not required, and no health information was gathered. Most care partners were adult children responsible for caring for a parent or parent-in-law living with dementia. Informed consent adopted a dementia-friendly approach to acknowledge the specific requirements of our sample, such as the potential for fluctuating capacity among participants which emphasizes the need for consent to be a process [70,71]. Accordingly, participants were first contacted *via* email and sent consent forms to review in their own time, at least one week ahead of the interview. A member of the research then followed up with a call connecting with each participant to obtain consent and allow for any questions to be asked. Verbal informed consent was obtained using the teach-back method [72] which supports non-discriminatory functional assessment of decision-making [73] by having participants demonstrate their understanding by recalling the main points of the consent form, such as the project aims, and any risks or benefits of taking part. Proxy assent was not required. In the final step, consent was reviewed again with each participant at the start of the interview.

Interviews

A semi-structured interview guide was developed from the prior policy analysis and infographic. The guide was divided into three sections: background and experiences of the participant, discussions on the results of the policy analysis, and perspectives on the future of social robot policy development. The infographic was used as a tool for knowledge translation enabling us to introduce the main findings from the analysis and focus discussions on the scope and priorities of existing social robot policies. The aim of the interview process was to encourage participant engagement and elucidate the lived experience, end-user perspective. Interviews were carried out by one of two research assistants with training in qualitative research methods. Researchers met one-on-one with participants for up to 45 min using a

university-hosted Zoom video call. Interviews were audio-recorded, transcribed verbatim and de-identified before analysis.

Interview coding

Transcripts were analyzed using inductive thematic content analysis which allows for themes to emerge from the data and researcher bias to be minimized [74]. Two members of the research team reviewed a single interview transcript to develop an initial coding guide by identifying emerging themes and subthemes from the data. A second interview transcript was then coded, inter-rater reliability was calculated, and any disagreements were resolved through discussion and refinement of the coding guide. This iterative process occurred until agreement between coders reached 90%. The final coding guide was used by an independent coder to code the entire sample using MAXQDA text coding software [75]. Data is presented as the number of interviews containing the theme over the total number of interviews ($n=17$), and the percentage of interviews containing that theme (%).

Results

We report participant quotes using the following acronyms: Professional Expert (PE), Care Partner (CP), and Lived Experience Expert (LE).

Experience and attitudes toward robots

Participants had a range of previous experience with social robots, including in-person interactions ($n=2$), familiarity with the concept ($n=11$), or no experience ($n=4$). Responses to initial discussion questions about ways that robots could be beneficial, whether or not participants would personally use or recommend a robot, and the perceived helpfulness of robots are reported in Table 2.

Concerns and challenges to adoption

Participants raised dementia-specific concerns regarding robot design ($n=15$ interviews). For example, when discussing desirable and undesirable robot features, participants commented, "A cuddly robot would be good for [people living with dementia]" (CP2), and that, "Something [...] with wires very rigid looking [...] I don't think it would appeal to somebody with dementia" (CP3).

Table 2. Interviewee responses to social robot discussion questions, given as % of interviews providing each response.

Response	Frequency (%)
<i>Potential uses for a social robot</i>	
Companionship	65
Human-robot communication	53
For specific populations, <i>e.g.</i> , dementia	41
Caregiving tasks	41
Everyday tasks	41
Mental health tool	41
<i>Would you use a social robot yourself?</i>	
I would use one today	38
I would consider using one in the future	56
No, I would not use one	7
<i>Would you recommend a social robot to a loved one?</i>	
Yes, I would recommend one	35
Uncertain. It would depend on the individual	53
No, I would not recommend one	12
<i>Helpfulness rating for social robots, scale of 1-5</i>	
Score of 3 (neutral)	38
Score of 4 (very helpful)	31
Score of 5 (extremely helpful)	38

Participants also discussed the unique challenges of designing for this population. A lived experience expert shared, “There is people with [...] different abilities to retain [operating instructions for a robot]. And it is just the biggest, the biggest issues” (LE1).

Privacy concerns were mentioned in all interviews (n=17). Transparency of data collection and use was referenced (n=13), with users wanting information to be handled “with the same amount of respect and care as you do with any other medical record” according to one care partner (CP6). The possibility that robots could invade boundaries arose (n=9), with the consensus that “collecting data without people’s knowledge [...] is not okay” (CP5). Another stated, “There has to be a boundary between what is acceptable and what is not acceptable [...] so that they don’t see you in the shower or on the toilet, that kind of thing” (CP3). Software security (n=9) and intrusive monitoring (n=7) were also identified as themes.

Participants cited general unfamiliarity with social robots (n=13 interviews), a lack of public trust (n=12), and a lack of alignment between robots and cultural and social norms (n=8) as the greatest challenges to social robot adoption by the public. As one example of a lack of public trust, one participant shared, “If there are adverse outcomes, particularly if those adverse outcomes are widely publicized, the lack of public trust, again, it is a moving target, it [adoption] may go up and down and back up and back down” (CP4).

Responsibility and consultation for policy development

Participants were asked their opinion on who should be responsible for creating social robot policy (Figure 2). Many participants identified

the government as a key contributor in developing policy, while some participants suggested the government should contribute from a distance. For example, one participant stated the government could play a consultative role in policy development. Another objected to industrial bodies’ involvement in policy making stating that developers “are not going to work on building this thing if they can’t make money off of it, and [...] at the end of the day, their motivations are going to be a bit skewed and biased towards their bottom line” (PE4).

When asked to reflect on who should be consulted in developing social robot policy, participants most commonly cited general end-users—a broad category referring to any user of robot technology—and gave frequent mention to medical professionals and care partners specifically (Figure 2). Two participants expressed a need to be selective about who to consult and objected to blanket inclusion of disease-specific organizations and private industries; motives behind investment funding for dementia programming and market-driven priorities were regarded as grounds for exclusion as they were regarded as having potential to shape policies in directions that misalign with the interests of people living with dementia.

Policy priorities

Feedback on existing recommendations

Recommendations found in social robot policies (Table 1) were given lay, normative descriptions and presented to participants for feedback. The following items were identified as priorities: (1) Respect human rights and dignity: robots should treat humans equally and respect their dignity, (2) Multi-stakeholder

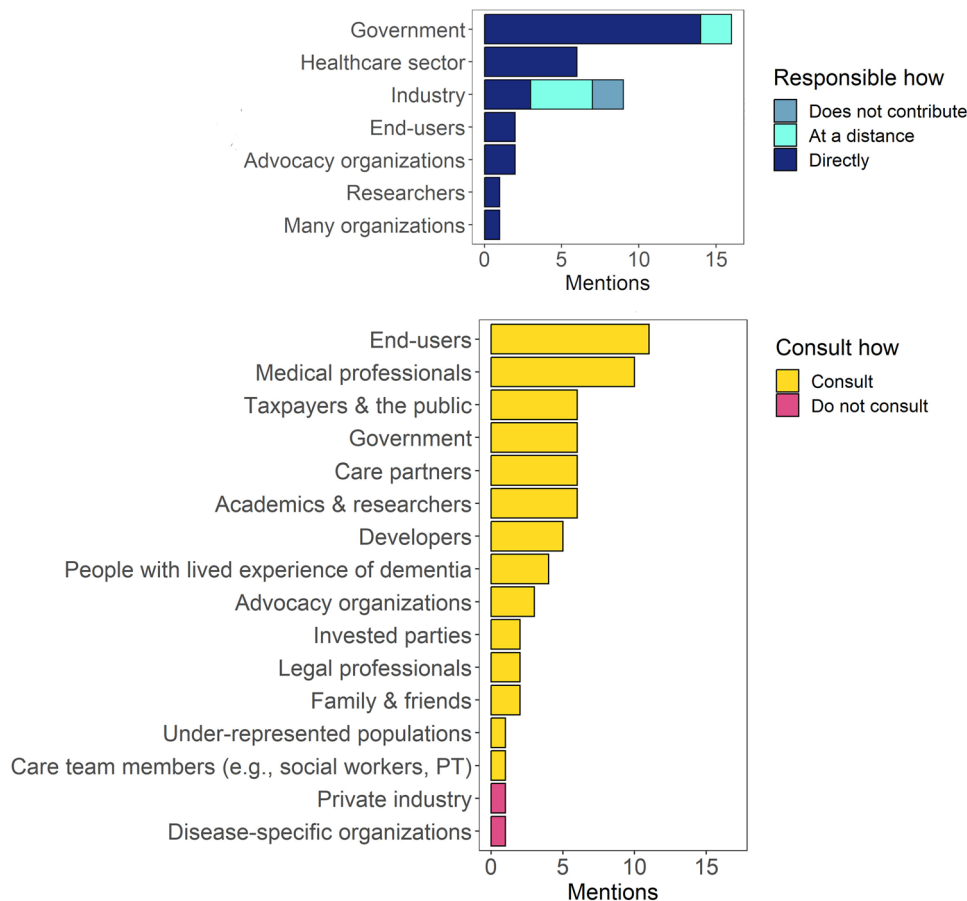


Figure 2. Responses from aging and dementia community member interviewees (n=17). A) “who should be responsible for social robot policy?” B) “who should be consulted to create social robot policy?”.

collaboration: people with different experiences and backgrounds should be involved in decisions regarding robotics, (3) Public engagement: the public should be consulted on the research, development and implementation of robotic systems, and (4) Ethical codes of conduct: an ethical code should be created to guide the research, development and implementation of robotic systems. These existing themes often overlapped in discussions with participants, who viewed them as interrelated in terms of policy creation.

Ethical conduct was the most discussed existing policy recommendation within our sample, with 36 mentions across all 17 interviews. Some participants ranked it as their top consideration when creating social robot policy: "Without ethics, there is nothing" (CP2). Participants acknowledged the importance of ethical conduct as a consideration when creating new policies but also questioned which specific ethical practices would inform the code: "I am a bit critical [...] an ethical code should be created to guide the research development and implementation of robotic systems because whose ethics get to inform that code?" (CP4).

Participants also emphasized multidisciplinary collaboration, public engagement, and respect for human rights and dignities with equal frequency. In terms of multidisciplinary collaboration, participants often cited reasons such as, "[it would be] be helpful to get different points of view and different ideas" (CP2). This recommendation was often contextualized as a form of public engagement. For example: "You are going to have academics in the room, and you are going to have technicians in the room, and you are going to have software people in the room, and you are going to have decisionmakers in the room, I would say take all of those people and add an equal number of public members" (CP5). Respect for human rights and dignity was oftentimes also related to public engagement, where participants reasoned that if many people are consulted in the co-creation of policies, respect for human rights and dignity would result due to the involvement of diverse groups.

Concerns

Participants also named a number of concerns as policy priorities. Attribution of liability (n=7) was identified, with one participant expressing "there has to be some kind of legal rules that if a robot does something then that company who made the robot can be held accountable" (CP1). Another theme was issues of economic inequality (n=7): "It is something that is only available to those who can afford it, so that, that is definitely a concern" said one professional expert (PE2). Other emerging themes were insufficient regulation (n=7), discrimination (n=6), deception (n=5), and bias (n=4).

Emerging recommendations

Participants made suggestions as to how to improve existing policies around social robotics based on their perspectives as members of the aging and dementia community (Table 3). Recommendations for future policy fell along four key themes:

1. Cost and accessibility: Respondents indicated that policies should promote low-cost robotics so that potential benefits of this technology are widely available. One participant stated, "At first, I was thinking oh, that is for rich people [...] and then I realized [...] that there is benefit, and that there is multiple ways in which social robots can have to improve lives" (PE1).

Table 3. Themes of emerging recommendations for social robot policy made by aging and dementia community members.

Emerging recommendation theme	Sample quotes
Cost & accessibility	"Keeping the cost [of social robots] low is probably a priority, just to be able to reach more people, and, I guess, the people who would benefit most from them". <i>Professional Expert 5</i>
Involvement of end-users & minority groups in policy development	"Engaging with people with lived experience [in policy-making] from racialized communities...or an indigenous community...is the most challenging part whenever you are talking about stakeholder consultation". <i>Professional Expert 3</i> "...involving patients in the governance and involving patients at the very beginning of [the policy-making] processes". <i>Care Partner 5</i>
Simple & standardized policies	"There was a need for national standards [of policy]". <i>Lived Experience Expert 1</i>
Aging & dementia-specific considerations	"...if more resources could be dedicated to helping people stay in their homes". <i>Professional Expert 1</i> "There is also a role to play for organizations who represent those end users. It is important to not just go to the end users themselves but the groups that maybe associated with those end users". <i>Professional Expert 2</i>

2. Involvement of end-users and minority groups in policy development: Speaking of end-users with dementia, one participant spoke to the need to involve end-users throughout all processes of policy development, "involving patients in the governance and involving patients at the very beginning of processes, as opposed to bringing them in to rubber stamp things or bringing them in at the implementation phase: 'We have decided this is what is best for you, now help us implement it'" (CP5). The importance of meaningful engagement with the dementia community was further underscored by one care partner who asserted, "I think the problem is people forget that just because people do have dementia [...] they still have opinions" (CP1). Concerning racialized or under-represented groups, another participant stated that policymakers approach their work, "From the lens of discrimination, [considering] what are the groups that are typically under-represented, and also what are the barriers to allowing people to actually participate candidly" (PE3).
3. Simple and standardized policies: Participants expected policies to be consistent and clearly communicated to the public. One care partner stated that "regulation needs to be simple, as simple as possible, and not so convoluted" (CP1).
4. Aging and dementia-specific considerations: Centering the needs of the aging and dementia community should be done through simple robot design, consultation with advocacy groups, and provision of support to care partners. A member of an advocacy organization said, "Organizations like ours can help to alleviate fears or to help people learn to, like, ask the right questions. [...] I mean I think that having people like [name] speak and show people what can happen and experiences that have happened, involve people who have lived experience, it makes such a difference" (PE2).

Discussion

As social robots are increasingly marketed to and adopted by the public, it is pressing to evaluate the state of social robot policy

to ensure that the procedures and guidelines that are developed are aligned with the needs of those impacted: individuals aging in the community, persons living with dementia, care partners, and professionals working with technologies for older adults. Using a two-part approach, we capture the contents of the social robot policy landscape and report expert perspectives on the quality, completeness, and deficiencies of policy materials. To avoid evaluating policy material from our singular perspective as one research team, we interviewed both lived experience experts and professionals in the fields of aging and dementia to gather their unique perspectives and promote meaningful engagement of the aging and dementia community in social robot research and development. The results of this policy analysis and expert consultation are relevant to policymakers, robot developers, and both current and future social robot users.

Alignment between policy and expert perspectives

Among the recommendations found in existing policies, our participants identified the following four themes as priority areas: respect for human rights and dignity, multi-stakeholder collaboration, public engagement, and regulation through ethical codes of conduct. We now discuss two additional themes that emerged in our interviews with experts by way of profession and lived experience.

First, the issue of cost and access arose. This maps onto the principle of justice (in terms of resource distribution) in biomedical ethics [76]. Smart home technologies, a category that includes social robots, have not yet been taken up by older adults at a wide scale in part because of price barriers [77]. Access to appropriate health care, screening, and technology shows disparities across lines of race, class, and geography [78,79]. Access to assistive technologies is often inconsistent across locations and public funding is lacking, leading to unmet needs even when technologies proven to be effective do exist [80]. Social robots and other technologies to support aging in place may also have barriers to access for individuals with disabilities; for example, touchscreens that cannot be accessed by a seated wheelchair user [81,82]. Current data on who is accessing real-world social robots is insufficient. A better understanding of who these users are and what impacts they are experiencing is necessary to support the development of equitable policy. Adoption of alternative models of assistive technology development and evaluation, such as the FASTER framework, can be applied to this problem [83]. Future policies must consider these equity and access issues in the robotics space [84].

Second, experts brought up policy considerations that were specific to dementia and aging. Older adults are often eager to learn about novel technologies and are willing to engage in co-design and value control of their data [82]. These trends were echoed in the present data, in which experts recommended that older adults and persons living with dementia be engaged as partners in social robot research and policy development and that their privacy and autonomy be prioritized. Barriers to technology use by older adults include a lack of familiarity with available devices, low technology literacy, low expectations about device performance, high expectations about the degree of effort required, and concerns about physical hazards such as tripping [6,82,85]. In the interviews, experts discussed design considerations for social robots that overlapped with existing work on dementia-friendly devices [6,7,25]; for example, the use of familiar form factors and the need for simplicity without infantilizing the user. They also mentioned roles for social robotics to assist care partners and considered the benefits (e.g., reducing care partner burden) and harms (e.g., impinging on a care partners role in the care team).

Strengths and limitations

The study's method had several strengths. The database search strategy was comprehensive, using multiple search engines and a list of relevant social robot organizations to ensure the most relevant policies were retrieved. Once key themes in the policies were identified, a variety of expert perspectives were solicited, allowing us to engage in a nuanced discussion of the strengths and weaknesses of the policy landscape. Semi-structured interviews allowed for a wide range of topics around responsibility, ethics, and public engagement about social robotics to be captured. By integrating an inductive approach into the development of the interview coding guide and analysis of transcripts our findings center on participants' perspectives about social robot policies and fill a knowledge gap in the literature. Further, thematic analysis of the policy documents was appropriate to this work as it enabled us to summarize the main points of multiple text-heavy documents without losing meaning and clearly communicate these to our participants.

The inclusion of persons with lived experiences of dementia and care partners was a priority in this work. Here we adopt an assets-based view of persons living with dementia, valuing their essential contributions to research as experts by experience. In alignment with the values of person-centred design and echoing the phrase "nothing about us, without us" [86], our work supports the view that persons living with experience of dementia are central to discussions on social robot policy. Here we demonstrate the potential for people living with dementia to be key collaborators in the development of policies, and that consultation can be a productive and meaningful activity when methods of knowledge sharing, and engagement are tailored to meet the needs of participants. Collating key findings from the policy analysis, and sharing these among our participants in a summarised, graphical format is one such example. We support the view that individuals living with dementia can provide actionable insights into their own experiences with technology [6,7,71,87–91], and emphasize the primacy and ethical imperative of engaging with lived experience experts at all stages of the project lifecycle [92–96].

Engagement with the dementia community is however not without challenges and complexities. For example, additional time may be required to carry out a multi-step consent process or have materials produced in a range of accessible formats, both of these are necessary considerations during study planning and budgeting. Therefore, we encourage researchers to adopt a flexible, proactive approach to research design and engagement which will support them in bridging research goals, ethics board requirements and the needs and wishes of participants from the dementia community [71]. (For additional guidance on how to conduct meaningful engagement in dementia research see [86,97–103]).

Despite these strengths, this work has a number of limitations. The transferability of this work is limited by our selection of experts which was restricted to Canada, and the omission of demographic and background information about our participants. Perspectives of more persons living with dementia would be valuable, as would perspectives of healthcare providers who interface with the dementia community, for example, nursing home staff. A more detailed understanding of participants' backgrounds, including ethno-cultural and social information, stage of dementia, and level of professional expertise would enhance our findings and reveal the diversity of opinions being represented in this work. We also did not speak with any technology experts such as engineers or computer scientists. This should be a focus in future work, with a larger sample of participants which may allow

for in-depth exploration of perspectives between user groups, i.e., people living with experience of dementia, and care providers. Additionally, future work may seek to explore social and cultural influences on policy development. Comparing and contrasting the findings across different geographical regions may provide sociotechnical insights that capture the diversity of perspectives and further highlight the values and priorities of social robot end-users. The decision to focus our policy sample to documents written in English and published only by organizations within the GPAL is a limitation. Country of provenance is an important consideration when exploring the global policy landscape. We note that while the GPAL and other coalitions such as the Confederation of Laboratories for Artificial Intelligence Research in Europe (CAIRNE) [104] demonstrate the collective efforts that are being made toward addressing policy challenges, there is a strong bias toward Western, industrialized countries among their members. Exploring the state of policy development being carried out in networks that exist beyond these geographical and sociocultural boundaries, is an important next step in understanding the policy landscape more broadly. Furthermore, we note that this study captures the social robot policy landscape at a particular moment in time and that new documents continue to be produced. The specific robotic devices on the market also continue to evolve, and so too will policies need to adapt as the user base changes. We acknowledge the temporal limitations of this study and the fast pace at which the field of social robots is moving. We therefore make a call for regular consultation with end-users of social robots and meaningful engagement about ethical application and the governance of advancing technical devices.

The future of social robotics, AI and policy

The content of the 47 policies we analyzed provides insights into how social robots are conceptualized by leading international organizations in this space. Concerns about discrimination, bias, deception, and threats to human autonomy arose frequently. Social robots in popular culture are often depicted as highly advanced, with complex motives, capable of great harm [105–107]. Currently available social robots are far more technically limited. However, the future of artificial social technologies is uncertain and could abruptly change. This volatility is demonstrated by the abrupt public emergence of Large Language Models- algorithms behind the likes of OpenAI's ChatGPT chatbot that can convincingly interact with a human user [108]. And while the full impact of this new software remains largely unknown [109–112], social robots that incorporate Large Language Models have begun to emerge [113]. Algorithms, even those based on very large datasets, can replicate existing forms of bias and discrimination [114–117] and offer seemingly 'intelligent' and personalized responses to the extent that it may deceive its user and provide false information, or 'hallucinations'. The potential for harm is particularly relevant to users living with cognitive impairment whose safety, autonomy, connection to others and susceptibility to manipulation may be more vulnerable than that of the general population [118]. Social robots that are increasingly sophisticated and autonomous pose undesirable risks; policies that address both the ethical concerns surrounding these technologies and meet the unique needs of the dementia community are urgently needed. Creating such policies demands that multi-stakeholder engagement is inclusive of lived experience and professional experts throughout the process. Participating in technology assessment, for example, allows for risks and benefits to be evaluated from the end-user's perspective. This not only drives innovation and governance toward better alignment with community values, but also democratizes

the process to empower end-users, minimize the risk of ableist paternalism, and foster trust [119,120]. However, challenging this process is the rapid pace at which social robot technologies are advancing which creates gaps in our knowledge base and results in policy lag. There is an urgent need to build stronger evidence of the impact of social robots and engage with the dementia community on an ongoing basis to generate user-informed policies that are responsive to evolving technological advancements. Operationalizing the value-driven policy recommendations presented in this work is a first step toward realizing these goals.

To support researchers and policy developers in this aim, here we present the four co-created policy recommendations, grounded in key ethical principles and described as actionable takeaways. We utilize the ethical adoption framework as a theoretical foundation in which to situate the policy recommendations and inform actionable steps for their implementation in future social robot policy development. The framework serves to bridge the gap between dementia technology research and practice and has the potential to "resolve key issues at the intersection of adoption and ethics through multiple channels, ensuring redundancy in addressing challenges and the maximization of benefits for end users" [47].

1. **Cost and accessibility:** Policies should promote robots that are affordable and widely available. To achieve this, regular review of market trends and academic literature is necessary to stay up to date about which social robots are proving most efficacious and accessible to the dementia community. As one example, researchers and policy developers should periodically check robot market reports, to gain high-level consumer insights which may be enhanced by recently published scientific evidence. Ethical principles: Justice and beneficence.
2. **Involvement of end-users and minority groups in policy development:** Engaging with a diversity of end-users ensures that policies are value-driven, meaningful and widely applicable. Researchers and policy developers should prioritize training in participant and public engagement, build competencies that emphasize end-user involvement and tailor approaches to better serve underrepresented and minority groups. Investments of time, money and resources should also be made to facilitate engagement strategies, including planning outreach programs and building long-term partnerships with key individuals, advisory committees and community groups. Requirements for end-user involvement should also be integrated into policy planning and research grant applications. Ethical principles: Beneficence, autonomy and justice.
3. **Simple and standardized policies:** Policies should be written in plain language and clearly communicate the key messages. Policies should be designed with accessibility and inclusivity in mind and offered in a variety of formats and languages to meet a range of needs and communication styles. Policy language should be developed in consultation with end-users and informed by best practice guidelines and toolkits for communicating with the dementia community e.g., Dementia Engagement and Empowerment Project (DEEP) resources [121]. Professional publication services should also be used to develop accessible documents and support knowledge translation across a range of formats. Ethical principles: Beneficence, autonomy and justice.
4. **Aging and dementia-specific considerations:** End-users should be at the heart of policy development. Researchers

and policy developers should consult with the dementia community throughout all stages of design, development and deployment to ensure that social robot policies are centred around their needs and preferences. A holistic, systems-level approach should be employed to prompt consideration for the complex needs of primary robot users, and those of indirect users, such as care partners or healthcare staff. As one example, training and education should be offered to robot end-users to improve familiarity with the technology, promote independence and positive outcomes of using the robot, and minimize potential risks or harms. Ethical principles: Autonomy, nonmaleficence, beneficence and justice.

Conclusion

Social robots for aging and dementia exist at the interface of two dynamic fields: healthcare and technology. Models of healthcare must transform in the next decade to meet the needs of a rapidly aging population. At the same time, new artificial, interactive, life-like agents are disrupting the education, healthcare, and technology worlds in rapidly evolving ways, and are ripe for integration with existing social robotic technology. In this study, we identify areas of critical need within existing social robot policy that end-users regard as essential requirements for meaningful and ethical development and deployment of these innovative devices. Priority areas for social robot policies include cost and access, involvement of a variety of potential users in policy development, the need for clear, straightforward, and consistent policy, and careful consideration of the needs of older adults and persons living with dementia. These priorities reflect the values and perspectives of the dementia community, providing actionable steps for the creation of user-informed recommendations and social robot policies.

Acknowledgments

The authors wish to thank Stephanie Quon for coding assistance and the older adult members of the Lived Experience Expert Group for their insights.

Author contributions

Jill A. Dosso: Formal Analysis, Visualization, Writing- Original Draft; Susanna E. Martin: Writing-Review and Editing; Haiger Ye: Conceptualization, Methodology, Formal Analysis, Investigation; Gabriella K. Guerra: Investigation, Formal Analysis; Anna Riminchan: Formal Analysis, Writing- Original Draft; Julie M. Robillard: Supervision, Funding Acquisition, Conceptualization, Methodology, Writing- Review and Editing.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by AGE-WELL NCE, the Canadian Consortium on Neurodegeneration in Aging, and the BC Children's Hospital Foundation.

Notes on contributors

Julie M. Robillard, PhD, is a Scientist in Patient Experience at BC Children's and Women's Hospital and Health Centre, and Associate Professor of Neurology at the University of British Columbia (UBC). Dr. Robillard leads the Neuroscience, Engagement and Smart Tech (NEST) lab, where she brings her multidisciplinary background in neuroscience and biomedical ethics to the study of issues at the intersection of patient experience, brain health and technology.

Jill A. Dosso, PhD, is a Lecturer in the Department of Psychology at the University of British Columbia. At the time of the study Dr. Dosso was as Postdoctoral Research Fellow under PI Robillard in the NEST lab.

Haiger Ye, *Gabriella K. Guerra* and *Anna Riminchan* were undergraduate research assistants in the NEST lab during the study.

Susanna E. Martin is a Research Project Assistant in the NEST lab.

Data availability statement

The data that support the findings from this study are available upon request of the authors.

References

- [1] Tao G, Charm G, Kabacińska K, et al. Evaluation tools for assistive technologies: a scoping review. *Arch Phys Med Rehabil*. 2020;101(6):1025–1040. doi:10.1016/j.apmr.2020.01.008.
- [2] Canada Medical Association. Canada's elder care crisis: addressing the doubling demand; 2021. <https://www.cma.ca/sites/default/files/pdf/health-advocacy/activity/CMA-LTC-Deloitte-Report-EN.pdf>
- [3] MacDonald B-J, Wolfson M, Hirdes JP. The future cost of long-term care in Canada; 2019.
- [4] Kabacińska K, Vu K, Tam M, et al. "Functioning better is doing better": older adults' priorities for the evaluation of assistive technology. *Assist. Technol*. 2023;35(4):367–373. doi:10.1080/10400435.2022.2113180.
- [5] Astell AJ, McGrath C, Dove E. 'That's for old so and so's!': does identity influence older adults' technology adoption decisions? *Ageing Soc*. 2020;40(7):1550–1576. doi:10.1017/S0144686X19000230.
- [6] Dosso JA, Bandari E, Malhotra A, et al. User perspectives on emotionally aligned social robots for older adults and persons living with dementia. *J Rehabil Assist Technol Eng*. 2022;9:20556683221108364. doi:10.1177/20556683221108364.
- [7] Dosso JA, Kailley J, Guerra G, et al. Older adult perspectives on emotion and stigma in social robots. *Front Psychiatry*. 2022;13:1051750. doi:10.3389/fpsy.2022.1051750.
- [8] Gitlin LN. Why older people accept or reject assistive technology. *Gener J Am Soc Aging*. 1995;19:41–46.
- [9] Pape TL-B, Kim J, Weiner B. The shaping of individual meanings assigned to assistive technology: a review of personal factors. *Disabil. Rehabil*. 2002;24(1-3):5–20. doi:10.1080/09638280110066235.
- [10] Pandey AK, Gelin R. A mass-produced sociable humanoid robot: pepper: the first machine of its kind. *IEEE Robot Automat Mag*. 2018;25(3):40–48. doi:10.1109/MRA.2018.2833157.
- [11] Seal-Type Robot "PARO" to be marketed with best healing effect in the world; 2004 https://www.aist.go.jp/aist_e/list/latest_research/2004/20041208_2/20041208_2.html
- [12] DeVault D, Artstein R, Benn G, et al. SimSensei kiosk: a virtual human interviewer for healthcare decision support. *Proc. 2014 Int. Conf. Auton. Agents Multi-Agent Syst., International*

- Foundation for Autonomous Agents and Multiagent Systems. Richland, SC; 2014. p. 1061–1068.
- [13] Apple Inc., Siri, Apple Can; 2024. <https://www.apple.com/ca/siri/>
- [14] Amazon.com, Inc. Amazon Alexa – Learn what Alexa can do | Amazon.com; 2024. https://www.amazon.com/b?node=21576558011&ref_=alxcom_lrnmore_btn_23
- [15] Wright J. Inside Japan's long experiment in automating elder care, MIT Technol. Rev.; 2023. <https://www.technologyreview.com/2023/01/09/1065135/japan-automating-eldercare-robots/>
- [16] Tang A, Ho R, Yu R, et al. Editorial: can artificial intelligence help us overcome challenges in geriatrics? *Geriatr Nurs*. 2023;52: a 1–A2. doi:10.1016/j.gerinurse.2023.06.007.
- [17] Karami V, Yaffe MJ, Gore G, et al. Socially assistive robots for patients with Alzheimer's disease: a scoping review. *Arch Gerontol Geriatr*. 2024;123:105409. doi:10.1016/j.archger.2024.105409.
- [18] Ling Geoffrey CEL. Social Robots Play Nicely with Others, *Sci. Am.* <https://www.scientificamerican.com/article/social-robots-play-nicely-with-others/>
- [19] Vincent J. NY State is giving out hundreds of robots as companions for the elderly, *The Verge*; 2022. <https://www.theverge.com/2022/5/25/23140936/ny-state-distribute-home-robot-companions-nysofa-elliq>
- [20] Broadbent E, Peri K, Kerse N, et al. Robots in older people's homes to improve medication adherence and quality of life: a randomised cross-over trial. In: M. Beetz, B. Johnston, M.-A. Williams (Eds.), *Social Robotics*. Cham: Springer International Publishing; 2014. p. 64–73.
- [21] Pu L, Moyle W, Jones C, et al. The effectiveness of social robots for older adults: a systematic review and meta-analysis of randomized controlled studies. *Gerontologist*. 2019;59(1): e37–e51. doi:10.1093/geront/gny046.
- [22] Robinson H, MacDonald B, Broadbent E. The role of health-care robots for older people at home: a review. *Int J Soc Robotics*. 2014;6(4):575–591. doi:10.1007/s12369-014-0242-2.
- [23] Shishehgar M, Kerr D, Blake J. A systematic review of research into how robotic technology can help older people. *Smart Health*. 2018;7:8:1–18. doi:10.1016/j.smhl.2018.03.002.
- [24] Shishehgar M, Kerr D, Blake J. The effectiveness of various robotic technologies in assisting older adults. *Health Informatics J*. 2019;25(3):892–918. doi:10.1177/1460458217729729.
- [25] Bradwell HL, Edwards K, Shenton D, et al. User-centered design of companion robot pets involving care home resident-robot interactions and focus groups with residents, staff, and family: qualitative study. *JMIR Rehabil Assist Technol*. 2021;8(4):e30337. doi:10.2196/30337.
- [26] Petersen S, Houston S, Qin H, et al. The utilization of robotic pets in dementia care. *J Alzheimers Dis*. 2017;55(2):569–574. doi:10.3233/JAD-160703.
- [27] Robinson H, MacDonald B, Kerse N, et al. The psychosocial effects of a companion robot: a randomized controlled trial. *J Am Med Dir Assoc*. 2013;14(9):661–667. doi:10.1016/j.jamda.2013.02.007.
- [28] Robinson H, MacDonald B, Broadbent E. Physiological effects of a companion robot on blood pressure of older people in residential care facility: a pilot study. *Australas J Ageing*. 2015;34(1):27–32. doi:10.1111/ajag.12099.
- [29] Ostrowski AK, DiPaola D, Partridge E, et al. Older adults living with social robots: promoting social connectedness in long-term communities. *IEEE Robot Automat Mag*. 2019;26(2):59–70. doi:10.1109/MRA.2019.2905234.
- [30] Daly Lynn J, Rondón-Sulbarán J, Quinn E, et al. A systematic review of electronic assistive technology within supporting living environments for people with dementia. *Dementia*. 2019;18(7-8):2371–2435. doi:10.1177/1471301217733649.
- [31] Góngora Alonso S, Hamrioui S, de la Torre Díez I, et al. Social robots for people with aging and dementia: a systematic review of literature. *Telemed J E Health*. 2019;25(7):533–540. doi:10.1089/tmj.2018.0051.
- [32] Hirt J, Ballhausen N, Hering A, et al. Social robot interventions for people with dementia: a systematic review on effects and quality of reporting. *J Alzheimers Dis*. 2021;79(2):773–792. doi:10.3233/JAD-200347.
- [33] Jøranson N, Pedersen I, Rokstad AMM, et al. Effects on symptoms of agitation and depression in persons with dementia participating in robot-assisted activity: a cluster-randomized controlled trial. *J Am Med Dir Assoc*. 2015;16(10):867–873. doi:10.1016/j.jamda.2015.05.002.
- [34] Jøranson N, Pedersen I, Rokstad AMM, et al. Group activity with Paro in nursing homes: systematic investigation of behaviors in participants. *Int Psychogeriatr*. 2016;28(8):1345–1354. doi:10.1017/S1041610216000120.
- [35] Jøranson N, Pedersen I, Rokstad AMM, et al. Change in quality of life in older people with dementia participating in Paro-activity: a cluster-randomized controlled trial. *J Adv Nurs*. 2016;72(12):3020–3033. doi:10.1111/jan.13076.
- [36] Libin A, Cohen-Mansfield J. Therapeutic robot for nursing home residents with dementia: preliminary inquiry. *Am J Alzheimers Dis Other Demen*. 2004;19(2):111–116. doi:10.1177/153331750401900209.
- [37] Boada JP, Maestre BR, Genís CT. The ethical issues of social assistive robotics: a critical literature review. *Technol. Soc*. 2021;67:101726. doi:10.1016/j.techsoc.2021.101726.
- [38] Naneva S, Sarda Gou M, Webb TL, et al. A systematic review of attitudes, anxiety, acceptance, and trust towards social robots. *Int J Soc Robotics*. 2020;12(6):1179–1201. doi:10.1007/s12369-020-00659-4.
- [39] Moyle W, Jones C, Sung B, et al. What effect does an animal robot called CuDDler have on the engagement and emotional response of older people with dementia? A pilot feasibility study. *Int J of Soc Robotics*. 2016;8(1):145–156. doi:10.1007/s12369-015-0326-7.
- [40] Tamura T, Yonemitsu S, Itoh A, et al. Is an entertainment robot useful in the care of elderly people with severe dementia? *J Gerontol A Biol Sci Med Sci*. 2004;59(1):83–85. doi:10.1093/gerona/59.1.m83.
- [41] Frennert S, Östlund B. Review: seven Matters of concern of social robots and older people. *Int J Soc Robotics*. 2014;6(2):299–310. doi:10.1007/s12369-013-0225-8.
- [42] Hebesberger D, Koertner T, Gisinger C, et al. A long-term autonomous robot at a care hospital: a mixed methods study on social acceptance and experiences of staff and older adults. *Int J Soc Robotics*. 2017;9(3):417–429. doi:10.1007/s12369-016-0391-6.
- [43] Robillard JM, Hoey J. Emotion and motivation in cognitive assistive technologies for dementia. *Computer*. 2018;51(3):24–34. doi:10.1109/MC.2018.1731059.
- [44] Soraá RA, Tøndel G, Kharas MW, et al. What do older adults want from social robots? A qualitative research approach to Human-Robot Interaction (HRI) studies. *Int J Soc Robotics*. 2023;15(3):411–424. doi:10.1007/s12369-022-00914-w.
- [45] Whelan S, Murphy K, Barrett E, et al. Factors affecting the acceptability of social robots by older adults including people with dementia or cognitive impairment: a literature review. *Int J Soc Robotics*. 2018;10(5):643–668. doi:10.1007/s12369-018-0471-x.
- [46] Prescott TJ, Robillard JM. Are friends electric? The benefits and risks of human-robot relationships. *iScience*. 2021;24(1):101993. doi:10.1016/j.isci.2020.101993.

- [47] Robillard JM, Cleland I, Hoey J, et al. Ethical adoption: a new imperative in the development of technology for dementia. *Alzheimers Dement*. 2018;14(9):1104–1113. doi:10.1016/j.jalz.2018.04.012.
- [48] Hung L, Liu C, Woldum E, et al. The benefits of and barriers to using a social robot PARO in care settings: a scoping review. *BMC Geriatr*. 2019;19(1):232. doi:10.1186/s12877-019-1244-6.
- [49] Bates M. Robotic pets: a senior's best friend? *IEEE Pulse*. 2019;10(4):17–20. doi:10.1109/MPULS.2019.2922565.
- [50] Sharkey A, Sharkey N. Granny and the robots: ethical issues in robot care for the elderly. *Ethics Inf Technol*. 2012;14(1):27–40. doi:10.1007/s10676-010-9234-6.
- [51] Coghlan S, Waycott J, Lazar A, et al. Dignity, autonomy, and style of company: dimensions older adults consider for robot companions. *Proc ACM Hum -Comput Interact*. 2021;5(CSCW1):1–25. doi:10.1145/3449178.
- [52] Fosch-Villaronga E, Lutz C, Tamò-Larrieux A. Gathering expert opinions for social robots' ethical, legal, and societal concerns: findings from four international workshops. *Int J Soc Robotics*. 2020;12(2):441–458. doi:10.1007/s12369-019-00605-z.
- [53] Villaronga EF. What do roboticists need to know about the future of robot law. In *New Friends conference proceedings. New Friends 2nd International Conference Social Robots in Therapy and Education, Barcelona* Google Scholar. 2016.
- [54] Meehan EJ. Policy: constructing a definition. *Policy Sci*. 1985;18(4):291–311. doi:10.1007/BF00135916.
- [55] Schreiber D, Wang RH, Durocher E, et al. Access to assistive technology in Canada: a jurisdictional scan of programs. In *Toronto, Canada: AGE-WELL NCE, University of Toronto, McMaster Health Forum, March of Dimes Canada*; 2017.
- [56] Kodate N, Maeda Y, Hauray B, et al. Hopes and fears regarding care robots: content analysis of newspapers in East Asia and Western Europe, 2001–2020. *Front Rehabil Sci*. 2022;3:1019089. doi:10.3389/freesc.2022.1019089.
- [57] Head BW, Alford J. Wicked problems: implications for public policy and management. *Adm. Soc*. 2015;47(6):711–739. doi:10.1177/0095399713481601.
- [58] United Nations General Assembly, Convention on the Rights of Persons with Disabilities. 2007. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_61_106.pdf
- [59] Mulvale G, Chodos H, Bartram M, et al. Engaging civil society through deliberative dialogue to create the first Mental Health Strategy for Canada: changing Directions, Changing Lives. *Soc Sci Med*. 2014;123:262–268. doi:10.1016/j.socscimed.2014.07.029.
- [60] Tomas V, Finlay B, Gentles SJ, et al. Development of policy recommendations to support a national autism strategy: case of a virtual and inclusive stakeholder engagement process. *Int J Health Policy Manag*. 2023;12(1):1–4.
- [61] Robillard JM, Kabacińska K. Realizing the potential of robotics for aged care through co-creation. *J Alzheimers Dis*. 2020;76(2):461–466. doi:10.3233/JAD-200214.
- [62] Astell AJ, Bouranis N, Hoey J, D.P.I. Area., et al. Technology and dementia: the future is now. *Dement Geriatr Cogn Disord*. 2019;47(3):131–139. doi:10.1159/000497800.
- [63] Nichol B, McCready J, Erfani G, et al. Exploring the impact of socially assistive robots on health and wellbeing across the lifespan: an umbrella review and meta-analysis. *Int J Nurs Stud*. 2024;153:104730. doi:10.1016/j.ijnurstu.2024.104730.
- [64] OECD, Digital. <https://www.oecd.org/en/topics/digital.html>
- [65] OECD, AI principles overview. <https://oecd.ai/en/principles>
- [66] GPAI, About - GPAI. <https://www.gpai.ai/about/>
- [67] Hsieh H-F, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res*. 2005;15(9):1277–1288. doi:10.1177/1049732305276687.
- [68] Ministry of Internal Affairs and Communications, Draft AI R&D Guidelines for International Discussions | Press Release, MIC ICT Policy; 2017. https://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/pressrelease/2017/7/28_05.html
- [69] European Commission. Ethics guidelines for trustworthy AI | Shaping Europe's digital future; 2019. <https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai>
- [70] Pyer M, Ward A. Developing a dementia friendly approach to consent in dementia research. *Aging Ment Health*. 2024;28(2):294–301. doi:10.1080/13607863.2023.2264216.
- [71] Robillard JM, Feng TL. When patient engagement and research ethics collide: lessons from a Dementia Forum. *J Alzheimers Dis*. 2017;59(1):1–10. doi:10.3233/JAD-161285.
- [72] Teachbacktraining.com – Teach Back Training. <https://teachbacktraining.org/>
- [73] Scholten M, Gather J, Vollmann J. Equality in the informed consent process: competence to consent, substitute decision-making, and discrimination of persons with mental disorders. *J Med Philos*. 2021;46(1):108–136. doi:10.1093/jmp/jhaa030.
- [74] Braun V, Clarke V. Can I use TA? Should I use TA? Should I not use TA? Comparing reflexive thematic analysis and other pattern-based qualitative analytic approaches. *Couns and Psychother Res*. 2021;21(1):37–47. doi:10.1002/capr.12360.
- [75] VERBI Software. MAXQDA 2020; 2020. www.maxqda.com
- [76] Feil-Seifer D, Mataric MJ. Socially assistive robotics. *IEEE Robot Automat Mag*. 2011;18(1):24–31. doi:10.1109/MRA.2010.940150.
- [77] Mallinson DJ, Shafi S. Smart home technology: challenges and opportunities for collaborative governance and policy research. *Rev Policy Res*. 2022;39(3):330–352. doi:10.1111/ropr.12470.
- [78] Dubay LC, Lebrun LA. Health, behavior, and health care disparities: disentangling the effects of income and race in the United States. *Int J Health Serv*. 2012;42(4):607–625. doi:10.2190/HS.42.4.c.
- [79] McDonough CC. The effect of ageism on the digital divide among older adults. *GGM*. 2016;2(1):1–7. doi:10.24966/GGM-8662/100008.
- [80] Mattison CA, Wilson MG, Wang RH, et al. Enhancing equitable access to assistive technologies in Canada: insights from citizens and stakeholders. *Can J Aging*. 2020;39(1):69–88. doi:10.1017/S0714980819000187.
- [81] Körtner T. Ethical challenges in the use of social service robots for elderly people. *Z Gerontol Geriatr*. 2016;49(4):303–307. doi:10.1007/s00391-016-1066-5.
- [82] Wang S, Bolling K, Mao W, et al. Technology to support aging in place: older adults' perspectives. *Healthcare*. 2019;7(2):60. doi:10.3390/healthcare7020060.
- [83] Wang RH, Kenyon LK, McGilton KS, et al. The time is now: a FASTER approach to generate research evidence for technology-based interventions in the field of disability and rehabilitation. *Arch Phys Med Rehabil*. 2021;102(9):1848–1859. doi:10.1016/j.apmr.2021.04.009.
- [84] Wang RH, Wilson MG. It is time for a national strategy on equitable access to assistive technology in Canada. *Healthc Manage Forum*. 2022;356–362.
- [85] Hoque R, Sorwar G. Understanding factors influencing the adoption of mHealth by the elderly: An extension of the UTAUT model. *Int J Med Inform*. 2017;101:75–84. doi:10.1016/j.ijmedinf.2017.02.002.
- [86] Alzheimer Society of Canada. Meaningful engagement of people with dementia – a resource guide; 2015.

- [87] Leorin C, Stella E, Nugent C, et al. The value of including people with dementia in the co-design of personalized eHealth technologies. *Dement Geriatr Cogn Disord*. 2019;47(3):164–175. doi:10.1159/000497804.
- [88] Liddle J, Worthy P, Frost D, et al. Partnering with people living with dementia and care partners in technology research and design: reflections and recommendations. *Aust Occup Ther J*. 2022;69(6):723–741. doi:10.1111/1440-1630.12843.
- [89] Liddle J, Worthy P, Frost D, et al. Personal and complex: the needs and experiences related to technology use for people living with dementia. *Dementia*. 2022;21(5):1511–1531. doi:10.1177/14713012221084521.
- [90] Mann J, Hung L. Co-research with people living with dementia for change. *Action Res*. 2019;17(4):573–590. doi:10.1177/1476750318787005.
- [91] Robillard JM, Lai J-A, Wu JM, et al. Patient perspectives of the experience of a computerized cognitive assessment in a clinical setting. *Alzheimers Dement Transl Res Clin Interv*. 2018;4:297–303. doi:10.1016/j.trci.2018.06.003.
- [92] Bethell J, Commisso E, Rostad HM, et al. Patient engagement in research related to dementia: A scoping review. *Dementia*. 2018;17(8):944–975. doi:10.1177/1471301218789292.
- [93] Domecq JP, Prutsky G, Elraiyah T, et al. Patient engagement in research: a systematic review. *BMC Health Serv Res*. 2014;14(1):89. doi:10.1186/1472-6963-14-89.
- [94] Illes J. Reflecting on the past and future of neuroethics: the brain on a pedestal. *AJOB Neurosci*. 2023;14(3):223–226. doi:10.1080/21507740.2023.2188282.
- [95] Lefkowitz A, Vizza J, Kuper A. Patients as experts in the illness experience: implications for the ethics of patient involvement in health professions education. *J Eval Clin Pract*. 2022;28(5):794–800. doi:10.1111/jep.13672.
- [96] Mann J. Canadian charter of rights for people with dementia. *Dementia*. 2020;19(1):63–67. doi:10.1177/1471301219876503.
- [97] Sixsmith A, Sixsmith J, Mihailidis A, Fang ML, editors. Knowledge, innovation, and impact: a guide for the engaged health researcher. Cham: Springer International Publishing; 2021. doi:10.1007/978-3-030-34390-3.
- [98] Canadian Consortium on Neurodegeneration in Aging. The Engagement of People with Lived Experience of Dementia (EPLD), Engagem. *People Lived Exp. Dement*. <https://www.epled.ca>
- [99] Snowball E, Aiken C, Norman M, et al. Engaging people with lived experience of dementia in research meetings and events: insights from multiple perspectives. *Front Dement*. 2024;3:1421737. doi:10.3389/frdem.2024.1421737.
- [100] Bechard LE, McGilton KS, Middleton LE, et al. Engaging people with lived experience of dementia in research: perspectives from a multi-disciplinary research network. *Can Geriatr J*. 2022;25:254–261. doi:10.5770/cgj.25.583.
- [101] Moreno M, Kline C, Shubeck E, et al. Engaging individuals living with dementia as stakeholders. *Alzheimers Dement. Transl Res Clin Interv*. 2023;9:e12366. doi:10.1002/trc2.12366.
- [102] Mannheim I, Schwartz E, Xi W, et al. Inclusion of older adults in the research and design of digital technology. *Int J Environ Res Public Health*. 2019;16(19):3718. doi:10.3390/ijerph16193718.
- [103] Martin SE, Zhang CC, Tam MT, et al. “That’s me at my best”: perspectives of older adults on involvement in technology research. *Med. Humanit*. 2024;50:648–656. doi:10.1136/medhum-2024-013030.
- [104] CAIRNE, Home | CAIRNE - Confederation of Laboratories for Artificial Intelligence Research in Europe CAIRNE - Confederation of Laboratories for Artificial Intelligence Research in Europe AI, CAIRNE - Confederation of Laboratories for Artificial Intelligence Research in Europe; 2024. <https://cairne.eu/>
- [105] Cave S, Craig C, Dihal K, et al. Portrayals and perceptions of AI and why they matter; 2018. <https://www.repository.cam.ac.uk/handle/1810/287193>
- [106] Oliveira R, Yadollahi E. Robots in movies: a content analysis of the portrayal of fictional social robots. *Behav Inf Technol*. 2024;43(5):970–987. doi:10.1080/0144929X.2023.2196576.
- [107] Sartori L, Bocca G. Minding the gap(s): public perceptions of AI and socio-technical imaginaries. *AI. AI & Soc*. 2023;38(2):443–458. doi:10.1007/s00146-022-01422-1.
- [108] Islam A. Top Large Language Models (LLMs) in 2023 from OpenAI, Google AI, Deepmind, Anthropic, Baidu, Huawei, Meta AI, AI21 Labs, LG AI Research and NVIDIA, MarkTechPost; 2023. <https://www.marktechpost.com/2023/02/22/top-large-language-models-llms-in-2023-from-openai-google-ai-deepmind-anthropic-baidu-huawei-meta-ai-ai21-labs-lg-ai-research-and-nvidia/>
- [109] Arora A, Arora A. The promise of large language models in health care. *Lancet*. 2023;401(10377):641. doi:10.1016/S0140-6736(23)00216-7.
- [110] Birhane A, Kasirzadeh A, Leslie D, et al. Science in the age of large language models. *Nat Rev Phys*. 2023;5(5):277–280. doi:10.1038/s42254-023-00581-4.
- [111] Harrer S. Attention is not all you need: the complicated case of ethically using large language models in healthcare and medicine. *EBioMedicine*. 2023;90:104512. doi:10.1016/j.ebiom.2023.104512.
- [112] Kasneci E, Sessler K, Küchemann S, et al. ChatGPT for good? On opportunities and challenges of large language models for education. *Learn. Individ. Differ*. 2023;103:102274. doi:10.1016/j.lindif.2023.102274.
- [113] Evans S. ChatGPT Gives Humanoid Robot Ability to Speak in Multiple Languages, *AI Bus*; 2023. <https://aibusiness.com/verticals/chatgpt-gives-humanoid-robot-ability-to-speak-in-multiple-languages>
- [114] Buolamwini J, Gebu T. Gender shades: intersectional accuracy disparities in commercial gender classification. In: *Conference on Fairness and Accountability*. Transpar, PMLR; 2018. p. 77–91.
- [115] Howard A, Borenstein J. The ugly truth about ourselves and our robot creations: the Problem of Bias and Social Inequity. *Sci Eng Ethics*. 2018;24(5):1521–1536. doi:10.1007/s11948-017-9975-2.
- [116] Manyika J, Silberg J, Presten B. What do we do about the biases in AI? *Harvard Business Review*. 2019. <https://hbr.org/2019/10/what-do-we-do-about-the-biases-in-ai>
- [117] Metz C. Who is making sure the AI machines aren’t racist. *New York Times* 15. 2021
- [118] Kubota A, Pourebadi M, Banh S, et al. Somebody that I used to know: the risks of personalizing robots for dementia care, in: *social science research network*, Rochester, NY. 2021. <https://papers.ssrn.com/abstract=3910089>
- [119] Ghosh P, Liedo B, Riek LD. The problem of ableist paternalism in assistive robotics, *HRI 2024 Workshop Assistive Applications, Accessibility, and Disability Ethics A3DE*. 2024. https://a3de-hri.github.io/2024/files/papers/ghosh_liedo_2024_a3de_problem_robotics.pdf
- [120] OECD. Technology policy; 2024. <https://www.oecd.org/en/topics/technology-policy.html>
- [121] Dementia Engagement and Empowerment Project. Involving people with dementia – DEEP. <https://www.Dementiavoices.Org.Uk/>; <https://www.dementiavoices.org.uk/deep-resources/involving-people-with-dementia/>