Zafrani, Gerontechnology (2026) 25:3
https://doi.org/10.4017/gt.2026.25.3.1610.5

A robot in the living room: Domesticating a robotic personal trainer in very old age

Oded Zafrani PhD[a], Galit Nimrod PhD[b], Yael Edan PhD[c]
[a]Department of Industrial Management, Sapir Academic College, Sderot, Israel; [b]Department of Communication Studies and The Center for Multidisciplinary Research in Aging, Ben-Gurion University of the Negev, Beer-Sheva, Israel; [c]Department of Industrial Engineering and Management, Ben-Gurion University of the Negev, Beer-Sheva, Israel

**Corresponding author: odedzaf@post.bgu.ac.il*

Abstract
The domestication theory explains how individuals integrate new technologies into their daily lives. This in-depth qualitative case study explores domestication in older age based on interviews conducted over three months with nine individuals aged 85-97, who received a socially assistive robot designed to support physical and cognitive activity. Data analysis followed the four stages of domestication: appropriation, objectification, integration, and conversion. Findings showed that appropriation involved motivations ranging from curiosity to practical goals. In the objectification stage, most participants primarily regarded the robot as a functional tool. Integration varied: Some embedded the robot into daily routines, while others used it sporadically. Yet, across usage patterns, the robot reinforced participants' self-image as active, healthy, and adventurous. Conversion revealed differences in social sharing: Some involved family and peers, whereas others remained neutral or detached. The findings indicate that older adults' domestication of a socially assistive robot reflects both common trajectories and significant individual differences. Still, even when the technology is primarily functional, its domestication may yield a variety of emotional and social benefits.

Keywords: domestication theory, human-robot interaction, older adults, socially assistive robots, wellbeing

Introduction

Domestication Theory (Silverstone et al., 1992), both an analytical lens and a methodological approach, has become one of the most prominent frameworks for multidisciplinary research seeking to explain how technologies are integrated into everyday life (Fortunati, 2009; Haig-Smith & Tanner, 2016). With growing recognition of the potential benefits of technological solutions in general, and Socially Assistive Robots (SARs) in particular, for enhancing older adults' autonomy and quality of life, several studies have applied domestication theory to explore technology adoption and use in later life (Matassi et al., 2019; Nielsen, 2025; Nimrod & Edan, 2022). However, studies have seldom examined the domestication process longitudinally or within real-life settings, and none have focused on the domestication of SARs. This gap limits our understanding of how domestication unfolds, evolves, and stabilizes over time, and prevents us from capturing the everyday circumstances that shape older adults' adaptation to SARs.

To address this gap, the present in-depth qualitative case study provided older adults with a SAR for three months and tracked their experiences in real-life contexts, offering deeper insights into the domestication of technology in later life.

Literature review

Technology Domestication Theory

Technology Domestication Theory (Silverstone et al., 1992) is widely used in multidisciplinary research to examine the adoption, rejection, use, and integration of new technologies within households (Haig-Smith & Tanner, 2016). In other words, it describes the processes by which innovations are "tamed" or appropriated by users (Silverstone & Hirsch, 1992; Silverstone & Haddon, 1996). Initially, the theory focused on the domestic sphere, exploring how the adoption and use of new technologies are shaped by technological affordances, individual preferences, and the temporal, practical, economic, and social dynamics of family life (Watulak & Whitfield, 2016). However, as Haddon (1994, p. 8) suggested, "processes outside the home interact with the activity within the home." Consequently, domestication research has expanded beyond the household to include a range of contexts, such as businesses, industries, educational institutions, and health care services, that can be analyzed through economic, cultural, and sociological lenses (Harwood, 2011; Lindner, 2013). The theory thus addresses the broader socio-cultural landscape in which technology adoption occurs, encompassing both the pre- and post-adoption stages of specific technology (Haddon, 2006; Haig-Smith & Tanner, 2016).

The technology domestication theory argues that when users engage with technology, four intersecting processes occur: appropriation, objectification, integration, and conversion (Bakardjieva, 2011; Lim, 2008; Silverstone, 1992). Through appropriation, individuals acquire the technology and decide whether and how it fits their lives. Objectification is expressed through the use and display of objects in the home environment, revealing the value placed on those who identify with these objects. Integration refers to how objects are incorporated into daily rituals (the users and their environments change and adapt accordingly). Conversion then connects the household's moral economy with the outside world, referring to how users transfer their use of the new technology to others (Watulak & Whitfield, 2016). All these processes occur within the context of the household's moral economy (Lim, 2008). While objectification and integration occur within the household's internal structure, appropriation and conversion broaden the boundaries of the household into the outside world (Lim, 2016). The interplay of these processes determines the nature and patterns of technology use that eventually result in the social transformation of the household (Lim, 2008). Similarly, technologies acquire meanings and are incorporated in accordance with the household's own values and interests (Silverstone & Hirsch, 1992).

From a social perspective, domestication theory views technology adoption as an intricate, tension-filled process (Watulak & Whitfield, 2016). It highlights the interpretative flexibility individuals demonstrate in making sense of new technologies (Kline & Pinch, 1999) and emphasizes the central role of users in shaping adoption processes of new technologies (Patala et al., 2014). The theory traces the trajectory of technology adoption from initial acquisition to the point at which a technology becomes embedded in a person's everyday routines (Chigona et al., 2010), and accounts for both use and non-use (Watulak & Whitfield, 2016). Importantly, the domestication approach considers both the practical and the symbolic dimensions of technology, illustrating how material functions and personal or cultural meanings work together to integrate new technologies into daily life (Ayotunde, 2012).

Technology domestication among older adults

Since the early stages of domestication research, older adults have been recognized as a distinct user group with unique patterns of technology adoption (Haddon & Silverstone, 1996). Although the use of Information and Communication Technology (ICT) among older adults has grown substantially over the past two decades, their adoption of digital technologies remains considerably lower than that of younger age groups (Heart & Kalderon, 2013; Zhou et al., 2025). This disparity, often referred to as the "age divide," reflects the digital divide between younger and older users in terms of ICT adoption and use, leading to significant social inclusion challenges (Fang et al., 2018; Nimrod, 2018). Therefore, the domestication of technology in later life warrants particular attention.

Studies examining older users have drawn on domestication theory in different, context-specific manners. Among these studies, the seminal work by Haddon and Silverstone (1996) examined how "young-old" individuals aged 58–75 integrated traditional and new media into their daily routines. They demonstrated that earlier life experiences and the transition into retirement influenced patterns of media use and the nature of users' engagement with media, and they highlighted the ways in which media can partially offset certain physical and social losses associated with later life.

More recent work includes, for example, a study based on interviews with 20 citizens aged 75–91. In this study, Nielsen (2025) applied the domestication lens to examine how older adults adapt to and integrate digital health technologies into their everyday lives, focusing on the users and their practices rather than on the technologies themselves or their intended use. Viscovi (2018) applied domestication theory to explain how "warm experts" (defined as nonprofessional individuals who assist less experienced users in understanding and engaging with digital devices) participate in the early and ongoing phases of ICT adoption among older adults, particularly through appropriation and incorporation. By applying this framework, the study showed that integrating technology in later life is a socially embedded process that relies on trust, proximity, and continuous familial support rather than on technical skills alone. In addition, Matassi et al. (2019) drew on the domestication framework to examine how WhatsApp becomes embedded in everyday life. They found that older adults (aged 60 and above) use the platform less frequently than younger users, yet perceive it as a tool that strengthens interactions with family and friends and provides a connection to the world of younger generations.

Most domestication studies in later life have relied on qualitative approaches, typically using in-depth interviews and occasionally supplemented by additional qualitative or quantitative tools. Our literature review identified just three studies that observed older adults over time. Copelton (2010) followed a hospital-sponsored walking

club for five months, using observations and interviews to examine barriers to pedometer use. Rosales et al. (2017) tracked older adults' use of smartwatches over two months and assessed the benefits they derived from them. Nimrod and Edan (2022) studied women aged 75–90 who received Google Home (voice assistant) devices, documenting their experiences over three months through interviews, observations, and weekly surveys. Additional longitudinal studies have examined the use of robotic technology in later life (e.g., De Graaf et al., 2015; Van Maris et al., 2020, 2021; Zafrani et al., 2024). However, these studies usually focused on well-being outcomes rather than domestication processes and were typically limited in duration to a few weeks, with participants' ages primarily in the "young-old" segment (aged 65-75).

To the best of our knowledge, no study has yet employed a longitudinal approach to examine the domestication of SARs in later life among the "old-old" population (aged 85 and over, Burns et al., 2024). Applying the domestication framework can illuminate how the use of technology evolves with older users' experience, and this comprehensive perspective is essential for advancing the understanding of technology adoption and beneficial use in later life. This study examines the domestication of a SAR specifically designed to support physical and cognitive training in older adults. The robot was installed in the homes of nine "old-old" adults for a three-month period, during which participants could independently access and use the robot at their convenience.

Methods

The robotic system

In this in-depth qualitative case study, we used a SAR developed in our lab (*Figure 1*). The robot, named Gymmy to evoke associations with the word "gym," was intended to support physical activity in aging individuals. Each training session lasted 10-15 minutes, during which the robot demonstrated a series of physical exercises and monitored users' performance through a camera, correcting their execution when necessary. During the physical training, users are randomly presented with cognitive exercises, including memory and thinking tasks. Furthermore, at the end of each session, the system offered relaxation exercises designed to reduce stress and tension, following Jacobson's (1938) relaxation technique (for additional information about the development of the system, see Krakovski et al., 2021; Zafrani et al., 2023, 2024; or watch https://www.youtube.com/watch?v=zQ4T1NhS25Q). The training sessions were conducted independently by the participants, who could start, pause or terminate them at any time.

Physical exercises

Gymmy's physical training focused on upper-body exercises, consistent with the capabilities of the torso robot platform. These exercises were designed to enhance muscle strength and support older adults in maintaining independence and performing daily activities such as lifting objects. In total, 14 physical exercises were developed (Avioz-Sarig, 2019; Krakovski et al., 2021; *Figure 2*), based on the strength-training guidelines of the National Institute on Aging (NIH; https://go4life.nia.nih.gov/exercise-type/strength/ retrieved July 2019). In each training session, the user was exposed to eight randomly selected exercises presented in random order. Each exercise included eight repetitions, which were monitored by the robot.

Cognitive exercises

Gymmy's cognitive training component was designed to target various aspects of memory, processing speed, and concentration, which are essential for older adults' ability to maintain independent living (Arora, 2021; Eggenberger et al., 2015). Three types of cognitive games were integrated into the physical training: Working Memory, Spatial Memory, and Mathematical Skills, with two randomly selected for each session. These games were chosen based on prior research (e.g., Ezzati et al., 2016; Nacke et al., 2009). Each game began with on-screen instructions, after which users confirmed their readiness to start via the touch screen.

Relaxation exercises

Based on Jacobson's relaxation technique (Jacobson, 1938), Gymmy provided relaxation exercises aimed at reducing stress and tension. Such exercises are important for older adults' wellbeing (Rudnik et al., 2021) and target three muscle groups: arms, neck, and face. These exercises were offered as an additional activity, allowing participants to choose whether and when to perform them.

The participants

Participants were recruited through retirees' mailing lists, public notices, and snowball sampling. Eligibility criteria for participation were being 85 years old or over, and living independently in the community. Nine older adults participated (age range: 85–97 years; mean = 92, SD = 3.74). The sample consisted of two men and seven women. Although the sample size was small, participants were relatively homogeneous in key background characteristics, including independent community living and retirement status. All participants had children, most had completed secondary education, and all were retired. Participants were characterized by relatively low digital lit-

Figure 1. 'Gymmy' – Personal Training Robot.

eracy, reflected in their limited use of everyday technologies, mainly restricted to mobile phones and television, and their lack of prior experience or familiarity with robots. All experimental procedures received approval from the authors' institutional ethics committee (approval number 1722-1) and were carried out in accordance with its guidelines, including obtaining informed consent from all participants prior to the study.

Data collection

A Gymmy unit was installed in each participant's home for three months. In-depth, semi-structured interviews were conducted with each participant before and after the study (see Appendices A and B for the opening and concluding interview questions). During the initial meeting, participants received oral and written explanations about the study. After providing informed consent, they completed a questionnaire assessing demographic, sociodemographic, and health-related background characteristics. Each participant then received a detailed orientation to Gymmy, viewed a video demonstrating its functions, and was interviewed. In these interviews, participants described their biographical and occupational backgrounds, daily routines, and their use of ICT. These interviews also explored the perceived advantages, disadvantages, risks, and benefits of robotic technologies, as well as their specific expectations from Gymmy. Throughout the study, participants could ask for technical support whenever needed. At the end of the study period, concluding interviews were conducted to assess their overall experiences with Gymmy and to compare these experiences with their initial expectations.

Data analysis

The analysis followed Miles and Huberman's (1994) strategies of identifying patterns within the data, comparing and contrasting, and clustering. The first phase of the analysis was a within-case examination. Each participant's pre-use and concluding interviews were coded independently. The coding process was hybrid, employing open (inductive) coding and theory-based (deductive) coding grounded in Domestication Theory to link concepts and organize them into content-based categories. This process progressed from initial open coding to axial coding (grouping related concepts), and, finally, to selective coding according to the four stages of the domestication framework. This approach enabled reliance on preexisting concepts while allowing findings to arise directly from the data.

The first phase of the analysis resulted in the creation of nine distinct domestication stories organized according to the domestication process, described in terms of appropriation, objectification, integration, and conversion. Each story was rooted in participants' circumstances, real-life activities, and routines. In the second phase, a cross-case analysis was applied. In this phase, the nine stories were compared to identify similarities and differences across the cohort. The first part of the analysis was conducted by the first two authors and subsequently reviewed thoroughly by the third author. The second part was conducted by all three authors in a series of team discussions. To strengthen validity (Hammersley, 1992), the authors revisited and clarified codes that were unclear or contained discrepancies. As a result, the coding matrix was reorganized and supplemented with new categories and codes until full agreement between team members was achieved.

Findings

The analysis of the findings is organized according to the four stages of the domestication framework: appropriation, objectification, integration, and conversion (see Appendix C for a summary of themes and findings).

Appropriation

The robot was placed in participants' homes as part of the study, rather than through their own initiative, as most agreed to participate only after the opportunity was presented to them. The main motivation for this willingness was curiosity and a desire to experience the use of robotics. For example, Ms. T (86, Widow) shared: "I want to learn new things, I have curiosity... It's always good to know more things and to develop." For about half of the participants, curiosity was accompanied by another predefined goal focused on preserving or improving their physical and cognitive health. As Ms. M (86, Widow) explained: "I expect the robot to help me, especially with memory... That's what worries me the most."

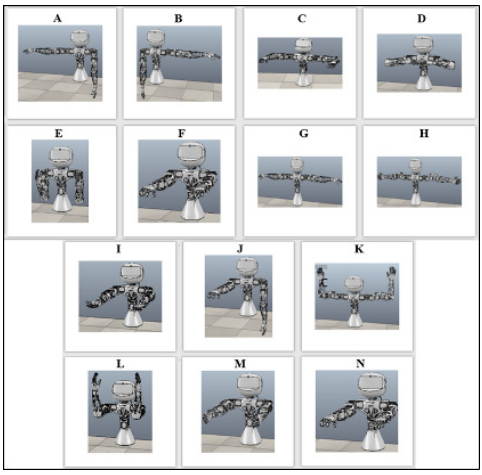

Figure 2. A&B- raise arms horizontally separately, C-raise arms and bend elbows forward 90, D-raise arms and bend elbows, E-bend elbows, F-raise arms forward static G-raise arms horizontally, H-raise arms horizontally and turn hands, I-raise arms forward and turn hands, J-raise arms forward separately, K-raise arms 90 and up, L-open and close arms 90, M- raise arms forward and to sides, , N- raise arms forward.

A key commonality that characterized the participants as they entered the study was their limited technological background, evident in their infrequent use of existing technologies, mainly restricted to mobile phone and television, and their lack of prior experience or familiarity with robots. Despite this limited technological background, it was possible to identify different anchoring points that accompanied their entry into the study. Some participants chose to emphasize their openness to new technologies and their willingness to experiment, as Mr. N (85, Married) noted, "I shop using the computer... I watch concerts and operas on YouTube." Others, however, chose to highlight their lack of prior experience and a sense of disconnection from the technological world. Ms. R (90, Widow), for example, clarified: "I don't even know what a robot is... I have no idea." Although the participants expressed different attitudes toward new technologies, none expressed fear of using robots or perceived them as dangerous or harmful. All regarded the robot as a neutral or even beneficial technological tool that did not evoke feelings of threat or resistance.

Alongside the sense of safety and the absence of fear toward the robot, several participants defined the boundaries of its use and their control over it from the very beginning. They clarified that the robot would be operated only when they wanted and according to their own terms, maintaining a full sense of control. Ms. C (85, Married) said, "When I want to," Mr. N (85, Married) added, "A robot that doesn't move," and Ms. T (86, Widow) highlighted, "I'll press a button, and it will do what I tell it to."

Objectification

All participants positioned the robot in their living room, both for convenience and to keep it visible as a reminder to use it. Ms. M (86, Widow), for example, pointed out that "when I see it, I remind myself that I should use it." Most participants perceived Gymmy as a simple, functional assistive tool with a clearly defined primary role of supporting their physical activity. Accordingly, participants became aware of minor malfunctions and inaccuracies that occurred during their use of the robot, yet they accepted these limitations and described Gymmy as convenient, easy to operate, and readily available for use whenever they wished. Mr. J (89, Widower) explained: "You can use it even twenty times a day, whenever you want… you're not dependent on anyone."

Moreover, about half of the participants established a certain emotional bond with the robot and showed some degree of anthropomorphism toward it. These participants demonstrated affection toward the robot, gave it compliments, and showed appreciation for the human characteristics they identified in it. "It's like a character… he looks like a human, so it's easier to connect with him… I became attached to him," stated Ms. K (85, Married). Similarly, Mr. J (89, Widower) highlighted that "you turn on the robot and spend time with Gymmy… he's really nice and friendly." Nevertheless, all participants, whether they had formed an emotional bond with the robot or not, set clear emotional boundaries, stressing that, ultimately and for better or worse, robots cannot serve as a substitute for human presence. Ms. T (86, Widow) summarized her perspective: "It may not be a person, but as long as it does what I ask it to, that's enough for me."

Integration

All participants incorporated Gymmy into their daily routines, although the extent and nature of this integration varied. While some used Gymmy daily at fixed times, others used it whenever it suited their schedule or preference. For example, Ms. T (86, Widow) shared a precise daily routine with Gymmy: "Twice a day I'm with him… in the morning around ten, and in the afternoon sometime between five and five-thirty." In contrast, Ms. K (85, Married) described a more fluid pattern of use: "Personally, I'm not very organized, so it wasn't always at fixed times. Sometimes I had different activities, like painting or French lessons… so in between, I found some time." A few reported that they initially engaged with Gymmy, but their use declined over time due to a lack of challenge.

Whether Gymmy was integrated into a structured routine or used in a more flexible and intuitive way, it did not replace existing forms of exercise (such as walking, Qigong, or Feldenkrais classes). It either initiated physical activity or complemented existing activities, helping participants maintain and diversify their routines. Furthermore, most participants reported that the robot motivated them to exercise more than they would have on their own. Ms. A (97, Widow) confessed: "It helped me engage in physical activity… I had never exercised before, I used to hate it," and Ms. B (91, Divorced) reflected: "If it weren't for it, who knows if I'd be doing these things."

Many also reported that they continued to use Gymmy even during challenging periods, such as days of bad mood or health difficulties. For instance, Ms. K (85, Married) recalled: "Recently I fell and had an accident… I couldn't really use my legs, so it was a pleasure to sit and exercise with Gymmy using my arms. It strengthens the arm muscles, and that's good," and Ms. B (91, Divorced) recounted that when she was alone, she "turn on the robot and spend time with nice Gymmy." Statements like these highlight Gymmy's role in sustaining participants' sense of identity, whether expressed through their need to remain active and engaged, to preserve their health, or to keep their minds stimulated.

Conversion

Many participants chose to present the robot proudly to those around them and shared the curiosity, encouragement, and admiration it evoked among their children, grandchildren, and great-grandchildren. As exemplified by Ms. C (85, Married), who described: "Everyone came to see how I use the robot… even one of my granddaughters filmed me using it and gave a presentation about it at school… she said it was wonderful." However, a few participants kept their experience with the robot to themselves and did not present it to others. This behavior did not stem from embarrassment or a desire to conceal their use of the robot, but rather from practical circumstances such as family members living far away.

Among some participants, the experience of using Gymmy led to a noticeable shift in their perception of robotic technology, moving from skepticism to openness ("It used to feel strange to me, how can you trust robots? But I guess the world is moving forward… I think robots have the potential to help older adults," Ms. M, 86, Widow), or from a neutral stance to a sense of appreciation ("I would really like to have robots at home…it's like a friend, and above all, it's helpful," Ms. K, 85, Married). Yet some participants maintained the neutral attitude they had when they began the study.

The period of interaction with Gymmy also shaped participants' perception of the potential of Gymmy and similar robotic technologies to assist the older adult population. Some noted that robotic technologies could assist the older adult population, whereas others framed this potential as being relevant mainly to specific groups of older adults, such as those who are lonely, physically limited, or living in nursing homes. For example, Ms. K (85, Married) explained: "It's more for people who are lonely… usually, those who are busy and have friends don't really think about using robots," while Ms. C (85, Married) suggested: "There's definitely a potential in robots…especially for people who don't go out much…I'd even put them in nursing homes."

Discussion

By following users longitudinally and in real-life conditions, this study revealed that older adults' domestication of a SAR involves both shared patterns and notable individual differences. Like previous research (Nimrod & Edan, 2022), the findings show that domestication is not a uniform process. In addition, they suggest that even when a new technology is perceived primarily as functional, its integration into daily life may yield a range of emotional and social benefits. Although participants ultimately regarded the robot as a utilitarian tool designed to support their physical activity, its presence nonetheless took on social and emotional significance.

The social significance was reflected in decisions such as placing the robot in central areas of the home enabled some participants to present themselves as open to innovation, a quality that older adults often associate with youthfulness (Matassi et al., 2019; Rosales et al., 2017). This emphasis was also evident in some participants' reports about introducing the robot to family members and peers, which could be regarded as a symbol of technological openness (Brintazzoli, 2018).

The emotional significance was evident in participants' engagement with the robot, which, in some cases, was accompanied by anthropomorphism, signifying a beneficial emotional effect of human-robot interaction (Roesler et al., 2021). The interaction also contributed to sustaining identity-related values such as staying active, maintaining health, supporting physical and cognitive functioning, and remaining open to new experiences. These values are closely tied to a desired sense of youthfulness (Hausknecht et al.,

2020). For several participants, this period of engagement marked a shift from initial skepticism to genuine openness, transforming doubt or neutrality into an appreciative recognition of robots and fostering a more positive emotional relationship with technology (Otaka et al., 2024).

In this context, the humanoid embodiment of Gymmy may have contributed to some of the social and emotional meanings observed in this study. Its human-like torso and movement capabilities enabled it to resemble a personal trainer, potentially facilitating imitation and supporting anthropomorphic interpretations. While the present findings are grounded in this specific embodiment, it remains an open question whether similar domestication dynamics would emerge with non-humanoid or appliance-like robotic systems. Future research should examine the role of embodiment in shaping domestication trajectories among very old adults.

Although social considerations play a significant role across various technologies used by older adults, the domestication trajectories observed in the present study reveal technology-specific distinctions. Prior research (Copelton, 2010) on older adults' walking groups has shown that monitoring technologies were often resisted because they were perceived as introducing competition and hierarchy, threatening the sociability and camaraderie that walkers valued most. The domestication of a SAR, as described in the current study, demonstrated an opposite pattern: Rather than jeopardizing social dynamics, the robot enabled participants to express social meanings, such as presenting themselves as youthful and open to innovation, and in some cases, sharing the robot with others as a symbol of technological openness. These contrasting patterns underscore that even when technologies support functional goals, their domestication is shaped by the specific social and symbolic meanings they afford.

Clear points of similarity and difference emerge between the domestication patterns observed in the present study and those reported by Rosales et al. (2017) regarding smartwatches. In both studies, older adults incorporated the new technology into existing routines and engaged with it in symbolically expressive ways, such as boasting about the smartwatch to appear technologically competent or introducing the SAR to family and friends as a marker of openness to innovation and youthfulness. Still, notable differences between the studies emerge. Smartwatch users did not report meaningful emotional or social benefits, nor did they view the device as addressing age-related needs. By contrast, participants in the present study derived clear social and emotional value from the SAR, including opportunities to express identity-related goals and a growing appreciation for the technology over time. Furthermore, while smartwatch users showed limited deepening of engagement and some continued to struggle with basic functions after two months, participants in the SAR study exhibited a more substantial shift from initial skepticism to genuine openness as domestication progressed.

An interesting parallel can be drawn to the domestication study by Nimrod and Edan (2022), which examined older women who received voice assistance devices for home use. The authors identified three domestication patterns (broad, focused, and restrained) based on the variety of uses. A similar pattern emerged in the present study based on frequency of use. Some participants made Gymmy a consistent part of their daily routine, while others used it sporadically, and a few initially experimented with Gymmy but eventually lost interest. However, a key difference distinguishes the two studies. In Nimrod and Edan's (2022) work, participants in the restrained domestication group experienced discomfort, frustration, and dissatisfaction. They encountered operational difficulties with the device, which reduced their motivation to use the voice assistant and reinforced the perception that it offered little meaningful benefit. In contrast, participants in the present study did not experience operational difficulties, as the SAR functioned smoothly and reliably throughout. Participants who used the robot sporadically did so due to other engagements or because they felt it was not challenging enough.

Methodologically, the present study provides additional evidence for the usefulness of the holistic approach to research on older technology users (Zafrani & Nimrod, 2019) and highlights the value of longitudinal methods in domestication studies. Our findings also add significant insights regarding the use of SARs in later life. Similar to previous longitudinal studies (De Graaf et al., 2015; Van Maris et al., 2020, 2021; Zafrani et al., 2024) that did not explore domestication, our findings indicate that older adults are open to interacting socially with robots and are able to integrate a social robot into everyday life by assigning it a meaningful role within their daily routines. However, the domestication framework applied in the present study, through its four stages, highlights the substantial importance of hedonic social interactions for accepting social robots within the household.

Beyond the functional value participants derived from using Gymmy, they enjoyed their interactions with it and seemed to benefit from a strengthened self-perception and social image as a result of using it. This stands in contrast to previous long-term studies that emphasized the utilitarian factor of practical benefit as the primary foundation for sustaining older adults' long-term engagement with social robots (De Graaf et al., 2015; Zafrani & Nimrod, 2019). Obviously, the importance of practical utilities should not be overlooked, as it is well established that when older adults did not perceive the robot as providing meaningful utility, they gradually lost interest, and eventually returned to their previous routines and habits without the robot (Frennert et al., 2017; Zafrani & Nimrod, 2019; Zafrani et al., 2024). Thus, a user experience that integrates both functional value and hedonic advantages tends to foster a deeper meaning and more enduring acceptance of the robot in domestic environments, creating a holistic sense of adoption that extends beyond practical benefits alone.

Without devaluing the present study's findings and implications, it is important to situate them within their methodological context. This study was designed as an in-depth qualitative case study of a specific type of socially assistive robot, characterized by its humanoid embodiment and exercise-oriented functionality, deployed among a small group of very old adults living independently in the community. Accordingly, the findings should not be generalized to all robotic systems or to the broader population of older adults. The contribution of this work lies in providing a rich, contextualized account of domestication processes as they unfolded within a particular technological configuration and domestic setting. Accordingly, it offers theoretically informed insights that may guide future comparative research across different SAR types and populations.

Conclusions

The domestication of robotic technology in later life can significantly enhance psychological and social well-being, even when the technology is perceived primarily as a functional tool. It can also help older adults preserve, and in some cases strengthen, their self-image as autonomous, independent, active, healthy, and open to new experiences. It does so by supporting their engagement in activities that reflect who they are and by reinforcing the personal capacities they wish to sustain.

To an extent, SARs can become more than a device. They can occupy a meaningful place in the rhythms of daily life in old and very old age and serve as an affirmation of who the older adults are and whom they aspire to remain. By doing so, SARs may reinforce older people's sense of continuity and their desire to maintain the abilities and qualities that they value. Moreover, SARs may provide a foundation for positive, satisfying interactions with family and friends, offering not only moments of connection but also opportunities for the older adults to express and share aspects of their identity, thus enriching their social relationships.

Funding information
This work was supported by a grant from the Israeli Ministry for Science and Technology (grant number: 3-15713) and partially supported by Ben-Gurion University of the Negev through the Agricultural, Biological and Cognitive Robotics Initiative, the Marcus Endowment Fund, and the W. Gunther Plaut Chair in Manufacturing Engineering.

Acknowledgments
The authors wish to thank Shai Givati, Moshe Bardea, Shikhar Kumar and Maya Krakovski for their help in carrying out this research.

References

Arora, S. (2021). Cognitive and Mental Health of Older Adults in India: Examining Differences Between Urban and Rural Regions (Doctoral dissertation, Palo Alto University).

Avioz-Sarig, O., Olatunji, S., Sarne-Fleischmann, V., & Edan, Y. (2021). Robotic system for physical training of older adults. International Journal of Social Robotics, 13(5), 1109-1124. https://doi.org/10.1007/s12369-020-00697-y

Ayotunde, A. (2012). Changing technologies and the Nigerian mass media. Kuwait Chapter of the Arabian Journal of Business and Management Review, 2(3), 94.

Bakardjieva, M. (2011). The Internet in everyday life: Exploring the tenets and contributions of diverse approaches. The handbook of internet studies, 11, 59-82. 10.1002/9781444314861

Brintazzoli, G. (2018). Technology, Care and a Sense of Home: Understanding Older People's Domestication of Telecare (Doctoral dissertation, University of Brighton).

Burns, S. D., Crimmins, E. M., Zhang, M., & Ailshire, J. A. (2024). Psychosocial Well-Being Differences Between the Young Old, Old-Old, and Oldest Old: A Global Comparison. Journal of Aging and Health. https://doi.org/10.1177/08982643241264587

Chigona, A., Chigona, W., Kausa, M., & Kayongo, P. (2010). An empirical survey on domestication of ICT in schools in disadvantaged communities in South Africa. International Journal of Education and Development Using ICT, 6(2), 21-32.

Copelton, D. A. (2010). Output that counts: pedometers, sociability and the contested terrain of older

adult fitness walking. Sociology of health & illness, 32(2), 304-318. https://doi.org/10.1111/j.1467-9566.2009.01214.x

De Graaf, M. M. A., Allouch, S. B., & Klamer, T. (2015). Sharing a life with Harvey: Exploring the acceptance of and relationship-building with a social robot. Computers in Human Behavior, 43, 1–14. https://doi.org/10.1016/j.chb.2014.10.030

Eggenberger, P., Schumacher, V., Angst, M., Theill, N., & de Bruin, E. D. (2015). Does multicomponent physical exercise with simultaneous cognitive training boost cognitive performance in older adults? A 6-month randomized controlled trial with a 1-year follow-up. Clinical interventions in aging, 10, 1335. https://doi.org/10.2147/CIA.S87732

Ezzati, A., Katz, M. J., Zammit, A. R., Lipton, M. L., Zimmerman, M. E., Sliwinski, M. J., & Lipton, R. B. (2016). Differential association of left and right hippocampal volumes with verbal episodic and spatial memory in older adults. Neuropsychologia, 93, 380–385. https://doi.org/10.1016/j.neuropsychologia.2016.08.016

Frennert, S., Eftring, H., & ÖStlund, B. (2017). Case report: Implications of doing research on socially assistive robots in real homes. International Journal of Social Robotics, 9(3), 401–415. https://doi.org/10.1007/s12369-017-0396-9

Fortunati, L. (2009). Theories without heart. In Cross-Modal Analysis of Speech, Gestures, Gaze and Facial Expressions (pp. 5-17). Springer, Berlin, Heidelberg.

Haddon, L. (1994). Lone parents and their information and communication technologies.

Haddon, L. (2006). The contribution of domestication research to in-home computing and media consumption. The information society, 22(4), 195-203. https://doi.org/10.1080/01972240600791325

Haig-Smith, T., & Tanner, M. (2016). Cloud Computing as an Enabler of Agile Global Software Development. Issues in Informing Science & Information Technology, 13. doi: org/10.28945/3476

Hammersley, M. (1992). Some reflections on ethnography and validity. Qualitative studies in education, 5(3), 195-203.

Harwood, S. A. (2011). The domestication of online technologies by smaller businesses and the 'busy day'. Information and Organization, 21(2), 84-106. https://doi.org/10.1016/j.infoandorg.2011.03.002

Hausknecht, S., Low, L. F., O'loughlin, K., McNab, J., & Clemson, L. (2020). Older adults' self-perceptions of aging and being older: A scoping review. The Gerontologist, 60(7), e524-e534. https://doi.org/10.1093/geront/gnz153

Heart, T., & Kalderon, E. (2013). Older adults: are they ready to adopt health-related ICT?. International journal of medical informatics, 82(11), e209-e231. https://doi.org/10.1016/j.ijmedinf.2011.03.002

Kline, R., & Pinch, T. (1999). The social construction of technology. The social shaping of technology, 2, 113

Krakovski, M., Kumar, S., Givati, S., Bardea, M., Zafrani, O., Nimrod, G., ... & Edan, Y. (2021). "Gymmy": designing and testing a robot for physical and cognitive training of older adults. Applied Sciences, 11(14), 6431. https://doi.org/10.3390/app11146431

Lim, S. S. (2008). Technology domestication in the Asian homestead: Comparing the experiences of middle class families in China and South Korea. East Asian Science, Technology and Society: An International Journal, 2(2), 189-209. https://doi.org/10.1215/s12280-008-9045-6

Lim, S. S. (2016). Asymmetries in Asian families' domestication of mobile communication. In Mobile Communication and the Family (pp. 1-9). Springer, Dordrecht. https://doi.org/10.1007/978-94-017-7441-3_1

Lindner, C. (2013). Assessing determinants of customer loyalty in an online news service context (Doctoral dissertation, University of East Anglia).

Matassi, M., Boczkowski, P. J., & Mitchelstein, E. (2019). Domesticating WhatsApp: Family, friends, work, and study in everyday communication. New media & society, 21(10), 2183-2200. https://doi.org/10.1177%2F1461444819841890

Miles, M. B., & Huberman, A. M. (1994). Drawing valid meaning from qualitative data: toward a shared craft. Educational Researcher, 13(5), 20–30. https://doi.org/10.3102/0013189x013005020

Nacke, L. E., Nacke, A., & Lindley, C. A. (2009). Brain training for silver gamers: effects of age and game form on effectiveness, efficiency, self-assessment, and gameplay experience. CyberPsychology & Behavior, 12(5), 493–499. https://doi.org/10.1089/cpb.2009.0013

Nielsen, A. S. (2025). Technology Maintenance: Older Adults Using Old Software on Old Computers. Journal of Technology in Human Services, 43(1), 1-19. https://doi.org/10.1080/15228835.2025.2451337

Nimrod, G. (2018). Technophobia among older Internet users. Educational Gerontology, 44(2-3), 148-162. https://doi.org/10.1080/03601277.2018.1428145

Nimrod, G., & Edan, Y. (2022). Technology domestication in later life. International Journal of Human–Computer Interaction, 38(4), 339-350. https://doi.org/10.1080/10447318.2021.1938395

Otaka, E., Osawa, A., Kato, K., Obayashi, Y., Uehara, S., Kamiya, M., ... & Kondo, I. (2024). Positive emotional responses to socially assistive robots in people with dementia: pilot study. JMIR aging, 7(1), e52443. 10.2196/52443

Patala, S., Jalkala, A., & Soukka, R. (2014). Methods for reducing buyer perceived risk related to the adoption of technological innovations. International Journal of Procurement Management, 7(1), 71-84. https://doi.org/10.1504/IJPM.2014.057868

Rosales, A., Fernández-Ardèvol, M., Comunello, F., Mulargia, S., & Ferran, N. (2017). Older people and smartwatches, initial experiences. El profesional de la información (EPI), 26(3), 457–463. https://doi.org/10.3145/epi.2017.may.12

Roesler, E., Manzey, D., & Onnasch, L. (2021). A meta-analysis on the effectiveness of anthropo-

morphism in human-robot interaction. Science robotics, 6(58), eabj5425. DOI: 10.1126/scirobotics.abj5425

Rudnik, A., Anikiej-Wiczenbach, P., Szulman-Wardal, A., Conway, P., & Bidzan, M. (2021). Offering psychological support to university students in Poland during the COVID-19 pandemic: Lessons learned from an initial evaluation. Frontiers in Psychology, 12. https://doi.org/10.3389/fpsyg.2021.635378

Silverstone, R., & Hirsch, E. (1992). Consuming technologies, media and information in everyday spaces.

Silverstone, R., Hirsch, E., & Morley, D. (1992). Information and communication technologies and the moral economy of the household. Consuming technologies: Media and information in domestic spaces, 13-28.

Silverstone, R., & Haddon, L. (1996). Design and the domestication of information and communication technologies: Technical change and everyday life. http://eprints.lse.ac.uk/64821

Van Maris, A., Zook, N., Caleb-Solly, P., Studley, M., Winfield, A., & Dogramadzi, S. (2020). Designing ethical social robots—a longitudinal field study with older adults. Frontiers in Robotics and AI, 7, 1. https://doi.org/10.3389/frobt.2020.00001

Van Maris, A., Zook, N., Dogramadzi, S., Studley, M., Winfield, A., & Caleb-Solly, P. (2021). A new perspective on robot ethics through investigating human–robot interactions with older adults. Applied Sciences, 11(21), 10136. https://doi.org/10.3390/app112110136

Viscovi, D. (2018). Warm experts for elderly users: Who are they and what do they do?. Human technology. https://doi.org/10.17011/ht/urn.201811224836

Watulak, S. L., & Whitfield, D. (2016). Examining college students' uptake of Facebook through the lens of domestication theory. E-Learning and Digital Media, 13(5-6), 179-195. https://doi.org/10.1177/2042753016689

Zafrani, O., & Nimrod, G. (2019). Towards a holistic approach to studying human–robot interaction in later life. The Gerontologist, 59(1), e26-e36. https://doi.org/10.1093/geront/gny077

Zafrani, O., Nimrod, G., & Edan, Y. (2023). Between fear and trust: older adults' evaluation of socially assistive robots. International Journal of Human-Computer Studies, 171, 102981. https://doi.org/10.1016/j.ijhcs.2022.102981

Zafrani, O., Nimrod, G., Krakovski, M., Kumar, S., Bar-Haim, S., & Edan, Y. (2024). Assimilation of socially assistive robots by older adults: an interplay of uses, constraints and outcomes. Frontiers in Robotics and AI, 11, 1337380. https://doi.org/10.3389/frobt.2024.1337380

Zhou, J., Salvendy, G., Boot, W. R., Charness, N., Czaja, S., Gao, Q., ... & Ziefle, M. (2025). Grand challenges of smart technology for older adults. International Journal of Human–Computer Interaction, 41(7), 4439-4481. https://doi.org/10.1080/10447318.2025.2457003

Appendix A: Opening interview guideline

General opening question:

1) Please tell me about yourself.
(Family, personal history including immigration if relevant, past and present employment, health status).

A comprehensive descriptive question:

2) Please describe your daily routine.

Questions that invite examples:

3) What are the main activities you do at home? Do you feel any difficulties performing daily tasks? Which difficulties? How do you deal with them?

4) Please tell me about your current usage of communication and information technologies such as computers, the internet, and mobile phones:
What are you using and why? (What are your main uses? Frequency of use?)
What are you not using and why?

General questions about the research:

5) Do you know any robots? Have you ever had an experience with a certain type of robot? Which robot/s? How would you describe the experience?

6) Have you heard of social robots? Have you had any experience with them? How would you describe the experience?

7) Why did you volunteer to participate in this study?

8) Do you think a robot can help you? how?

9) Do you think that robots have advantages over the technologies we talked about? Which advantages?

10) Do you think that robots have drawbacks compared with these technologies? Which drawbacks?

11) Do you think robots may be dangerous? In what way?

12) Are there certain areas where you would like to receive assistance from robots? Which areas?

13) Are there certain areas where you would not want to receive assistance from robots? Which areas?

14) Would you prefer a stationary or mobile robot? why?

15) Would you prefer a proactive robot or a robot that only responds? Why?

Questions to examine expectations Gymmy:

16) Why do you expect from your interaction with Gymmy?

17) Are there specific uses that you would like to benefit from using Gymmy?

18) Are there factors that can prevent you from using Gymmy, or influence how often you use it?

19) Do you think there are risks in using Gymmy?

Summary question:

20) Is there anything you would like to add, beyond what has already been discussed, about your expectations of Gymmy?

Appendix B: Concluding interview guideline

General opening question:

1) How would you describe your experience of using Gymmy? Did this use match your expectations? Was it enjoyable? effective? dangerous? challenging?

A comprehensive descriptive question:

2) Please describe your daily routine with Gymmy.

Questions that invite examples:

3) What were your main uses of Gymmy?
4) Were there uses that disappointed you?
5) Has your frequency of use of Gymmy increased/decreased over time? How? Why?
6) Do you feel that during the study period your lifestyle has become more active?
7) Do you feel that thanks to Gymmy, you have engaged more in physical activity?
8) Do you feel that thanks to Gymmy, it was easier and more accessible for you to perform physical activity?
9) Has Gymmy got you to engage in new exercises that you do not usually perform? How did it feel?
10) What were the difficulties you experienced during the period of using Gymmy?
11) Were there factors that prevented you from using Gymmy, or influenced your frequency of use? How?
12) After experiencing Gymmy, do you think robots may be dangerous? In what way?
13) Are there certain areas in which you expected to receive assistance from Gymmy but did not receive it? Which areas?
14) Do you think that exercising with Gymmy has any advantages over other physical activities? Which drawbacks?
15) Do you think exercising with Gymmy has any disadvantages compared to these activities? Which disadvantages?
16) Do you think the period of use of Gymmy made you more open to experimenting with other robots? How?
17) After experiencing Gymmy, do you think robots can assist older adults? How?

Summary question:

18) Is there anything you would like to add, beyond what has already been discussed, about your experience with Gymmy?

Appendix C: Summary of Domestication Stages, Themes, and Findings

Domestication Stage	Core Interview Themes	Representative Observed Behaviors & Findings
Appropriation	Motivations for participation; prior technological background; initial attitudes and boundaries.	**Motivations:** Primarily curiosity and a desire to learn. For about half of the participants, a goal to preserve physical or cognitive health (e.g., memory). **Anchoring:** Using existing tech (YouTube/Shopping) vs. feeling "disconnected" from the technological world. **Control:** Explicitly defining boundaries from the start ("I'll press a button," "Only when I want").
Objectification	Physical placement in the home; perception of the robot; emotional bonding.	**Placement:** All participants placed the robot in the living room as a visible reminder to exercise. **Perception:** Viewed as a "functional assistive tool" that is easy to operate. **Anthropomorphism**: About half developed an emotional bond ("character," "nice and friendly"). All set clear emotional boundaries against human substitute.
Integration	Daily routines; integration with existing habits; persistence in usage.	**Routine:** Ranging from fixed schedules (twice daily) to fluid, flexible use between other activities. **Synergy:** Complemented (rather than replaced) existing exercises like walking or Qigong. **Persistence in usage**: Continued use during low mood or health setbacks (e.g., exercising with arms after a leg injury).
Conversion	Social signaling and display; shift in technological perception; future outlook.	**Social Display:** Many proudly presented the robot to family. However, a few did not share it due to practical circumstances like family living far away. **Perception Shift:** Moving from skepticism or neutral stance to openness, appreciation, and seeing robots as "potential to help." **Future Potential:** Framing robots as essential for specific groups, such as those in nursing homes or the lonely.