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Robotic Pets as Resources: Transforming the Lives of the Unseen and Overlooked*

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Abstract

Older people often feel "invisible" in society, experiencing vulnerability due to restricted resources and diminished control. Their loved ones may also experience a spillover of this vulnerability. This study investigates robotic pets (robopets) as artificial intelligence–enabled resources that can enhance well-being for both groups. Automated text analysis of online customer reviews across four reviewer segments reveals that robopets' visual and tactile features enhance their perceived realism. This realism, alongside beneficiary attachment and prior pet ownership, positively relates to online ratings and beneficiary well-being. Qualitative analysis shows that robopets reduce vulnerability by restoring beneficiaries' capacity to care for something while helping loved ones manage difficult emotions. Studying lived experiences of robopet ownership transcends the typically temporary consumer–robopet interactions depicted in prior research. Our findings inform the design and marketing of robopets to those experiencing vulnerability. Ultimately, we provide evidence that robopets can enhance quality of life for older "invisibles" and those who care for them.

Keywords: Companion robots, Robotic pets, Vulnerability, Well-being, Transformer models, Buyer-based segmentation

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1. Introduction

The World Health Organization (2026) projects that by 2030, 1.4 billion people worldwide will be aged 60 years and older, with that number expected to rise to 2.1 billion by 2050, marking an unprecedented demographic shift. Despite this expected increase, older people who experience vulnerability—that is, have restricted access to and control over resources (Hill & Sharma, 2020)—often become "invisible"; they exist on the fringes of social consciousness and care systems (The Lancet, 2024), with their needs often overlooked.

The vulnerability older people experience is due to a complex mix of resource limitations, including diminished social capital and sense of belonging, decline in physical and cognitive capacities (Hill & Sharma, 2020; Sudbury-Riley et al., 2024), and increased dependency on others (Pavia & Mason, 2014). These factors collectively exert a considerable impact on their well-being (Kipnis et al., 2022), in terms of subjective emotional state (e.g., pleasure, happiness, pain avoidance), sense of purpose, and overall flourishing, reflecting hedonic and eudemonic dimensions (Ryan & Deci, 2001).

The experienced vulnerability and well-being challenges that older people face can have a major spillover effect on their family, friends, and caregivers (Sandberg et al., 2022). However, their burdens are often unrecognized by policy frameworks, service systems, and society, leaving them with insufficient support (Leino et al., 2021). The invisibility of older adults and their caregivers as consumers experiencing vulnerability is further heightened by their relatively limited representation in academic research (Berg & Liljedal, 2022), despite their circumstances constituting a pressing social issue (World Health Organization, 2026). Our overarching goal in this study therefore is to address one dimension of this pressing social issue by examining the role of an alternative resource—namely, robotic pets (hereinafter referred to as robopets)—in supporting consumers experiencing vulnerability and their secondary vulnerable loved ones in coping.

Robopets are physically embodied artificial intelligence– (AI-) enabled machines that emulate real animals by sensing and responding to beneficiary actions (Bradwell et al., 2021). Unlike AI designed to support older people's personal safety (e.g., fall detection devices) and independence (e.g., robots and smart home systems to assist with daily tasks such as medication adherence;

McDaniel et al., 2025), robopets are intended for social interaction, play, comfort, and companionship (Swarts, 2023).

As robopets can emulate the benefits of live pets, such as providing companionship, especially when they look, act, and sound like a real-life animal (Bradwell et al., 2021), they have the transformative potential to ameliorate experienced vulnerability and to enhance well-being. The benefits of robopets for older invisibles include their ability to reduce loneliness (Murayama & Takase, 2025), facilitate social engagement (Ihamäki & Heljakka, 2024), and reduce agitation (Fan et al., 2025). Some studies, however, also report downsides of robopets, such as dehumanization of care and deception, with meta-analyses indicating no overall positive impact on well-being (Abbot et al., 2019; Pu et al., 2019).

These mixed findings may be due to two main issues. First, prior studies have often assessed the impact of robopets after transitory exposure to them—for example, specific interaction sessions lasting between 10 and 40 minutes, occurring two to three times per week (Yuan et al., 2022), in shared settings (Abbott et al., 2019). In such settings, beneficiaries may not have the opportunity to develop a sense of attachment to or ownership of the robopet and therefore may not realize its full benefits, such as reducing loneliness (McColgan & Schofield, 2007). Second, reported well-being outcomes may vary depending on who assesses the impact of the robopet on the beneficiary, which has not been accounted for before. For example, Liu, Dallas, et al.'s (2019) choosing-for-others framework suggests that product satisfaction ratings depend on the chooser's social focus and consideration of individual consumption preferences. A preliminary analysis of robopet reviews on Amazon reveals that these products are typically purchased as gifts by friends or family members, by a primary caregiver, by healthcare professionals, or even by the beneficiaries themselves. Thus, considering who is making the assessment is critical when evaluating the uplift of well-being from robopet ownership.

To bridge these gaps in understanding robopets' impact on primary and secondary vulnerable consumers and address the mixed findings on the effectiveness of robopets, we employ a hybrid machine–human intelligence approach (Filieri et al., 2022) to quantitatively and qualitatively analyze online customer reviews. We focus on online reviews because they provide insights into actual lived

experiences of robopet ownership, from the perspectives of both beneficiaries and benefactors. Specifically, we address the following four research questions (RQs):

> ***RQ1:*** *What robopet attributes are positively associated with robopet realism?*
> ***RQ2:*** *What factors are associated with satisfaction ratings of robopets, and how do these vary by reviewer type?*
> ***RQ3:*** *What factors are associated with the improved well-being of the intended beneficiary of the robopet?*
> ***RQ4:*** *In what ways do robopets reduce vulnerability and improve well-being of the robopet beneficiary and their loved ones?*

By addressing these RQs, our study extends the literature on consumer vulnerability and well-being and the role of AI in several ways. First, we enrich understanding of how AI can serve as a transformative resource for invisibles (Hermann et al., 2024), specifically older beneficiaries (Dang & Bertrandias, 2025; Kipnis et al., 2022; Zeng et al., 2025). We show how robopet ownership enables older adults to regain control and agency by having something to care for without depleting their oftentimes already limited resources. Furthermore, robopets foster a sense of safety, security, and comfort, helping to alleviate anxiety. The cumulative effects of beneficiary responses to robopets reduce vulnerability and enhance well-being, an area that has not been the focus of prior work in this stream (Filieri et al., 2022; Riedel et al., 2021). Second, while prior research has conceptualized secondary vulnerability experienced by caregivers of primary vulnerable individuals (Carlini et al., 2026; Pavia & Mason, 2014), mitigation strategies remain underexplored. Our findings show that robopets function as effective coping mechanisms for secondary vulnerable individuals. Analogous to the documented spillover effects from primary to secondary vulnerable individuals (Pavia & Mason, 2014), we demonstrate that improvements in primary vulnerable individuals' quality of life due to the robopet correspondingly enhance hedonic well-being among their secondary vulnerable loved ones. Finally, we provide insights into the attributes of robopets and beneficiaries that are positively correlated with consumer satisfaction ratings and well-being outcomes, as determined by buyer-based segmentation (i.e., gifter, carer, healthcare professional, and self). For example, when beneficiaries

acquired the robopet for personal/self use, its realism, their level of attachment, and their past pet ownership/love for animals were positively associated with satisfaction ratings. However, only beneficiaries' past pet ownership/love for animals was associated with improved well-being. These findings offer valuable guidance for designers and marketers, by showing that perceived benefits differ by buyer segment. This insight is important given that robopet marketing has traditionally focused on the intended beneficiary (e.g., older adults, children) rather than the buyer (Amazon, 2025). Overall, our research aligns with the notion of leveraging AI for social good (Hermann et al., 2024) by showing how to harness AI to improve the well-being of consumers experiencing vulnerability, thereby leading to transformative outcomes.

In the following sections, we present a theoretical foundation for our work by reviewing literature on primary and secondary vulnerability and robopets as a companion-type robot and transformative resource. We then outline our method for analyzing online customer reviews of robopets, employing quantitative and qualitative approaches. Finally, we offer several implications for robopet designers and marketers.

2. Literature Review

2.1. Older people and their loved ones experiencing vulnerability

Understanding and supporting consumers experiencing vulnerability is an important marketing research priority that has accordingly gained increased attention (e.g., Riedel et al., 2021). Vulnerability arises from the interaction of individual states (e.g., loneliness), individual characteristics (e.g., reduced cognitive capacity), and external conditions (e.g., social isolation) (Baker et al., 2005) within a context in which consumption goals may be hindered and the experience may affect personal and social perceptions of the self (Del Bucchia et al., 2021). As such, anyone can experience vulnerability at any time, though certain groups, such as older people, may be more susceptible to it (Dang & Bertrandias, 2025; Glavas et al., 2020; Speering & Speering, 2021). Resources that can typically decline with age include physical resources, such as mobility; cognitive resources, such as memory; social resources, such as social networks (Zeng et al., 2025); economic resources, such as income; and emotional resources, which may manifest as increased anxiety. Thus, for some older people, experiencing vulnerability can often be a more enduring state, leading to

permanent liminality (O'Loughlin et al., 2023), whereby their vulnerability cannot be remediated (Pavia & Mason, 2014).

Owing to their experience of vulnerability, older people are often supported by and dependent on loved ones who may also make decisions on their behalf (Leino et al., 2021; Pavia & Mason, 2014). These caregivers themselves can become susceptible to "vulnerability spillover" that can adversely affect their own well-being (Sudbury-Riley et al., 2024), which is different from but related to the vulnerability of the older individual (Pavia & Mason, 2014). We refer to this phenomenon as "secondary vulnerability," also known as associate vulnerability (Fletcher-Brown et al., 2021). Secondary vulnerability occurs when caregivers face potential harm when their caregiving demands exceed their available resources (Carlini et al., 2026; Leino et al., 2021). This form of vulnerability is a by-product of being in a relationship with an older individual who may be impaired in some way (e.g., cognitively) (Pavia & Mason, 2014). Indeed, when caregivers are confronted with the challenges of caring for a loved one, they undertake a series of cognitive appraisals and draw on diverse internal and external coping strategies to handle the situation (Lazarus & Folkman, 1984). For example, in aged care settings, the context itself can trigger experiences of secondary vulnerability for family members, evoking strong emotions (Leino et al., 2021). This emotional strain can lead to diverse product needs among secondary vulnerable consumers, which may be related to their concern for the well-being of the primary vulnerable individual and/or their own need for emotional support (Leino et al., 2021).

2.2. Companion robots for older people

Companion robots are designed to establish emotional connections with humans and facilitate social interactions (Ahmed et al., 2024; Yuan et al., 2022) rather than providing task-oriented support. These robots can be humanoid in form or take the shape of an animal. For example, Abi is an AI-powered humanoid robot currently being trialed in several aged care facilities across Australia. Abi can recognize faces, understand emotions, and recall past conversations, enabling her to build relationships over time (RexFacts, 2025). The integration of companion robots in aged care is a major technological advancement aimed at addressing the challenges posed by aging populations globally (Huang & Oteng, 2023).

Reflecting this development, research in gerontechnology—the intersection of gerontology and technology—has increasingly focused on how companion robots can provide emotional and social support for older adults (e.g., Zhou, 2025). In parallel, marketing and service scholars have explored how companion robots can enhance the well-being of older people experiencing vulnerability (e.g., Dang & Bertrandias, 2025; Kipnis et al., 2022).

Companion robots can reduce loneliness and social isolation among older adults (Murayama & Takase, 2025) by facilitating social engagement through conversation, storytelling, and interactive activities (Ihamäki & Heljakka, 2024). They can also reduce agitation in older people with dementia (Fan et al., 2025). However, prior research has identified important challenges associated with companion robots (e.g., individual differences in consumer acceptance) and concerns about these robots potentially replacing human contact and care (Chiu et al., 2021; Ihamäki & Heljakka, 2024).

2.3. Transformative pets: real and robotic

Owning a real pet delivers various benefits, including stress reduction, companionship, comfort, distraction, and an improvement in both the quality and quantity of social interactions, all of which contribute to an enhanced quality of life and reduced vulnerability (Martins et al., 2023). Pets provide their owners with a sense of purpose and help foster feelings of control and empowerment, especially when self-management seems unmanageable (Brooks et al., 2018). However, ownership of real pets presents resource challenges, such as ongoing financial costs, care, and hygiene (Pu et al., 2019). Older individuals may face barriers to traditional pet ownership, including concerns about the pet outliving them, difficulties in providing adequate care, allergies, or the potential need to surrender cherished companions when relocating to residential facilities, which typically prohibit pets. For pet owners or animal lovers, the loss of this role identity is devastating, and, due to their advanced age, they may need to adjust to the prospect of never being a pet owner again (Ross & Baron-Sorensen, 1998). Furthermore, while animal-assisted therapy can benefit older adults with dementia, the risk of zoonotic diseases, animal aggression (biting or scratching), and compromised animal welfare (Lai et al., 2019) makes the use of alternative companions appealing.

Robopets offer many of the same emotional and social benefits as live pets without the burdens of real pet care (Meng et al., 2025; Zhou, 2025). They vary in form and price, ranging from

Hasbro's Joy for All companion cats and dogs (approximately US$180) to Sony's AIBO robotic dog (approximately US$3,000) and PARO, the therapeutic baby seal robot (approximately US$6,000). Research suggests that robopets can be as effective as a real pet in reducing loneliness among older adults in long-term care (Banks et al., 2008), while also fostering emotional connections (Ihamäki & Heljakka, 2024), improving mood (Pu et al., 2019), and reducing stress, anxiety, and blood pressure (Robinson et al., 2015). Some beneficiaries have also shown improvements in communication (Moyle et al., 2019). Robopets have thus been marketed to enhance older people's quality of life (Ageless Innovation, 2024b) and integrated into aged care systems. For example, New York State has distributed nearly 5,000 robopets to socially isolated older adults (New York State Office for the Aging, 2024).

However, robopets are not without drawbacks. Some beneficiaries find their toylike designs infantile or feel uncomfortable forming emotional bonds with machines (Bradwell et al., 2021; Moyle et al., 2019; Weber-Guskar, 2021). A broader concern is that positioning technology as a substitute for human interaction risks dehumanizing care (Chiu et al., 2021). Practical barriers, including high cost, privacy issues, and infection control in shared settings, further complicate their adoption (Koh et al., 2021).

Understanding what value robopets can offer requires insight into how they work and who they work for. Though not as intuitively responsive as real pets, robopets leverage integrated AI to sense and respond to their owners (Ihamäki & Heljakka, 2024), and their visual, tactile, and auditory realism contributes to a positive sensory experience (Abbott et al., 2019). Beyond these features, the benefits individuals derive from robopets are influenced by personal characteristics. Grounded in attachment theory (Ainsworth & Bowlby, 1991), the bonds people form with pets foster a sense of safety and security (Sharkin & Knox, 2003), which become especially meaningful when experiencing vulnerability, when personal resources are most depleted. Prior pet ownership and a general love for animals may further determine how much an individual stands to benefit from robopet companionship (Moyle et al., 2019).

3. Method

Following Filieri et al.'s (2022) method, we adopt a hybrid approach combining machine learning and human intelligence to examine robopet customers' well-being as expressed via online reviews. Specifically, we employ two semi-automated quantitative approaches to detect consumer well-being in online reviews: transformer-based machine learning (Hartmann et al., 2021; Jiang et al., 2023) and guided latent Dirichlet allocation (LDA) (Dzyabura & Peres, 2021; Hajek et al., 2023). This process enables us to examine well-being from customers' unstructured textual reviews. To validate the results and deepen insights, we supplement the semi-automated text analysis with qualitative analysis, applying Spiggle's (1994) iterative framework of categorization, abstraction, and integration.

3.1. Data

Similar to Boegershausen et al. (2022), we implemented a structured data collection approach. For our analysis, we focus on the robopet brand Joy for All for three reasons. First, Joy for All is the only major brand that specifically designs its products to meet the needs of older adults, particularly those experiencing loneliness. The Joy for All website explicitly states that its companion pets make the perfect gift for older adults, alleviating "feelings of isolation or loneliness, without expensive vet bills!" Other robopet brands (e.g., Perfect Petzzz) are not specifically designed for older adults, making it difficult to isolate the impact of robopets on older adults' well-being. Second, Joy for All offers robopets in three forms (cats, dogs, and walker-squawker birds), with several varieties, as Figure 1 illustrates (Ageless Innovation, 2024a). These robopets are designed to replicate the look, feel, sounds, and movements of "real" animals, using sensors to autonomously respond to touch and light in ways that encourage user stroking, cuddling, and speaking (Ong et al., 2022; Swarts 2023). This variety in product offerings caters to heterogeneous consumer preferences for pet types and enables us to analyze consumer responses across different robopet features. Third, Joy for All robopets are affordably priced, with cats and dogs retailing for around $180 and birds for $65 (Ageless Innovation, 2024a). Their affordability has made them among the most widely adopted robopets (Swarts, 2023), enabling us to collect a substantial volume of reviews from diverse customer groups.

Figure 1. Joy for All sample of companion pets [6].

We focus on the e-commerce platform Amazon because it is both the largest e-commerce provider and the primary data source for academic research on online reviews (Boegershausen et al., 2022; Hajek et al., 2023; Wang et al., 2023). To capture comprehensive customer experiences, we collected all Amazon reviews for all Joy for All robopets posted between December 1, 2016, and January 22, 2026, via the data provider Apify.

We applied several exclusion criteria during data collection. First, to avoid interlingual comparison difficulties in automated text analysis, we only included Amazon websites from four primarily English-speaking countries: Australia, Canada, United Kingdom, and United States. Second, for the same reason, we excluded all non-English language reviews (e.g., reviews written in French). Third, we only included reviews in which the intended robopet recipient was an older adult. Our final sample included 3,693 reviews of the three types of Joy for All robopets (cats, dogs, and walker-squawker birds).

3.2. Variable operationalization

3.2.1. Review rating

Reviewers on Amazon rate products on a 1 to 5 scale. Owing to the negative skewness in the distribution of product ratings (skewness = –2.02, *SE* = 0.04), we followed Zhao et al. (2026) and

6 Source: https://joyforall.com/?srsltid=AfmBOooSGj-cPqNoOLLdzo3RShCJehHslaEQONlmTYXA0Bm-1M3Yr5uC#

applied log-transformation to normalize this variable and used the transformed value as one of our outcome variables of interest.

3.2.2. Improved well-being

An uplift in well-being can be complex to detect in reviews; for example, for some beneficiaries, improved well-being was expressed in terms of increased comfort, companionship, and entertainment, while for others, it was conveyed as positive emotions, such as joy and happiness. To navigate this semantic complexity, we use RoBERTa, a state-of-the-art transformer-based language model (Liu, Ott, et al., 2019) that can interpret the meaning of words by context (Hartmann et al., 2021). This capability makes it well-suited for detecting mentions of improved well-being in review data.

We began by randomly selecting 1,644 reviews (44% of the corpus). Two human coders independently checked for the presence (coded 1) or absence (coded 0) of improved well-being in each of the reviews. Only reviews for which both coders agreed on the presence of improved well-being were assigned a value of 1; all others were coded as 0. Using this annotated subset, we fine-tuned the pre-trained RoBERTa model to detect well-being references specifically within the context of Amazon reviews. Following the guidelines of Hartmann et al. (2021) and drawing from the transformers library (Wolf et al., 2020), we tuned our model with the following hyperparameters: a RoBERTa-large architecture, a learning rate of 2×10^{-5}, and three epochs. We set the maximum sequence length to 128 and maintained a batch size of eight for both training and evaluation. Table A1 in Appendix A includes details of the training aspects. Then, following Ludwig et al. (2022), we evaluated the performance of the fine-tuned model by comparing its predictions with human annotations. The results reveal strong agreement (precision = .926, recall = .961, F1-measure = .943). We then deployed the fine-tuned model on the remaining 2,049 reviews to infer the presence or absence of improved well-being.

3.2.3. Realism, attachment, and past pet ownership/love for animals

We manually coded realism, attachment, and past pet ownership/love for animals as binary indicators, where 1 denotes the explicit presence of the concept in the review and 0 its absence. Specifically, we classified a review as expressing realism if it described the robopet as lifelike,

realistic, or convincingly animal-like. We coded attachment as present if the beneficiary gave their robopet a name (e.g., Snowflake) and/or expressed love, adoration, or affection for the robopet (e.g., "Fluffy! It was love at first sight. Instant bond"). Finally, we coded past pet ownership/love for animals as 1 if the review mentioned that the beneficiary had owned pets previously or expressed a strong general affection toward animals.

3.2.4. Robopet features

To identify textual cues of the visual, tactile, auditory, and movement features of robopets, we followed the dictionary development process based on Rocklage et al. (2018). Before developing the dictionaries, we pre-processed the review data by tokenizing the text, converting all characters to lowercase (e.g., "Robopet" to "robopet"), and removing punctuation, numbers, and symbols. We then excluded common English stop words (e.g., "the," "and") and generated n-grams ranging from unigrams (n = 1) to 5-grams (n = 5) to capture significant multi-word phrases, such as "battery life" or "realistic movement." To consolidate related terms, we applied word stemming to reduce variations (e.g., "running," "runs," and "ran") to their root forms (e.g., "run"). Finally, we converted the tokenized corpus into a document-feature matrix (Benoit et al., 2018).

After the pre-processing, first, we extracted the 1,000 highest frequency words from the review corpus. Second, three coders assessed whether each word represented the robopets' (1) visual, (2) tactile, (3) auditory, or (4) movement features. We added words to each dictionary only if all three coders agreed. We then used the validated list of words representing these four sensory features as seed terms in the guided LDA model (Dzyabura & Peres, 2021; Peng et al., 2020). This approach allowed us to identify related but less frequently occurring words that also might represent the four features. From the LDA output, we extracted the 1,000 most frequent words that co-occurred with the seed words. Again, three coders reviewed the new wordlists, applying the same definitions, to decide if further words could be added to the existing lists; only words approved by all three coders were included. The final dictionaries consist of 22 words for visual, 28 for tactile, 27 for auditory, and 27 for movement. Table A2 in Appendix A includes all the words for each of these dictionaries. Using these dictionaries, we calculated the proportion of attribute-specific words relative to the total word

count in each review, which resulted in four variables corresponding to the visual, tactile, auditory, and movement robopet features.

3.2.5. Reviewer type

We manually coded the type of reviewer to capture the relational context in which the robopet was evaluated using several cues in the review text. We assigned each review to one of four categories, which was based on the reviewer's relationship to the beneficiary of the robopet: (1) gifter, (2) carer, (3) healthcare professional, and (4) self. Specifically, we classified reviews as "gifter" if reviewers explicitly mentioned purchasing the robopet as a gift for the beneficiary. This was typically for a birthday, Christmas, or Mother's Day, and the gifter was commonly a family member or friend. We applied the "carer" category when reviewers identified themselves as a caregiver to the beneficiary, such as a family member or support person. Although they purchased the robopet for the beneficiary, typically their mother, father or partner, the reviews did not mention that this was a gift. We applied the "healthcare professional" category when reviewers identified themselves as a clinician, therapist, or staff member in a professional care setting and if they mentioned residents or patients as the beneficiaries of the robopets. Finally, we classified reviews as "self" when reviewers indicated that they had purchased the robopet for themselves; they typically used first-person language when describing their own experiences (e.g., "Husband said no more cats UNTIL our dog passes and she's 11 years old. I saw this [robopet] and got it right away"). We also coded reviews as "self" when it was not explicit who the reviewer was. This reviewer classification enabled us to account for systematic variation in review content based on the reviewer's relationship to the product and its intended beneficiary.

3.2.6. Additional communicative and contextual variables

We considered several text and non-text-related covariates that may be associated with our outcome variables. Because longer reviews may be more likely to mention key constructs, we controlled for the total number of words used in each review. We also controlled for variation in linguistic style by measuring review concreteness (Brysbaert et al., 2014) and emotionality (Hutto & Gilbert, 2014). In line with research on multimodal persuasion (Hartmann et al., 2021), we account for the number of images in each review. We used the same dictionary method as for the robopet

features to identify words indicating disability and controlled for reviews mentioning disability (1 = mention, 0 = no mention). Table A3 in Appendix A shows the list of words. Finally, we included reviewers' country of residence for potential differences in cultural expression (Hofstede, 2011).

3.3. Empirical models

To account for the nature of the outcome variables of interest—realism (binary), ratings (continuous), and improved well-being (binary)—we employed different modeling approaches suited to the scale and distribution of each outcome variable. Specifically, model 1 investigates the likelihood that a review expresses realism using a logistic regression model, and model 2 uses linear regression to analyze the log-transformed ratings given by the reviewers. Both these models include the same set of covariates: robopet features (visual, tactile, auditory, and movement), attachment, past real pet ownership or professed love for animals, reviewer type (i.e., gifter, carer, healthcare professional, and self), word count, concreteness, emotionality, country of the reviewer (Canada, United Kingdom, and United States relative to Australia), verified buyer, position among the reviews, number of images, and a binary variable denoting whether a disability was mentioned with respect to the beneficiary. Model 3 builds on model 2 by also incorporating interaction terms between the reviewer type and robopet perceptions to test for potential moderation effects of reviewer type. Models 4 and 5 test the presence of improved well-being in reviews using logistic regression. For all models, we accounted for potential intra-product correlations by using heteroskedasticity-consistent standard errors clustered at the product level.

3.4. Addressing potential biases in online consumer reviews

3.4.1. Addressing fake reviews

Companies may be motivated to create fake reviews, either themselves or through bots (Hajek et al., 2023). These fake reviews can bias our analysis by inflating ratings and misrepresenting actual consumer welfare implications. While Amazon has implemented several measures to combat fake reviews (Amazon, 2025), we took two additional steps to correct for biases arising from fake reviews. First, we ensured that our dataset contained no duplicate reviews (i.e., the same reviewer posting identical comments multiple times). Second, we included a dummy variable indicating whether the

reviewer was a verified purchaser, to account for potential differences between verified buyers and others.

3.4.2. Addressing timing bias

Reviews written at different times may systematically differ in ways that bias our analysis. For example, early reviews often come from enthusiastic early adopters, creating rating patterns that do not reflect typical customer experiences (Iyengar et al., 2011). Furthermore, products can change over time as companies fix any problems or modify designs; consequently, older and newer reviews may describe different versions of the same product. In addition, later reviewers may be influenced by reading earlier reviews (Herhausen et al., 2019). To address these timing-related biases, we included year fixed effects and accounted for each review's position in the sequence of all reviews of a given product in our analysis.

3.4.3. Addressing strategic behavior of reviewers

Anticipating that other potential customers will read and be influenced by their reviews, reviewers may strategically emphasize certain attributes, such as pet features, realism, attachment, or past pet ownership or affection, for rhetorical effect. Although we controlled for an extensive list of textual and non-textual elements, this unobserved strategic behavior could introduce endogeneity. To account for such endogeneity, we adopted a control function approach (Petrin & Train, 2010) and leveraged peer-based instruments. In model 1, we instrument the sensory predictors (visual, tactile, auditory, and movement), and in models 2–5, we instrument the psychological constructs (i.e., realism, attachment, and past pet ownership/love for animals). Specifically, following Sridhar et al. (2016), we constructed leave-one-out instruments by averaging the target construct across all other reviews in the dataset for each focal review. In the first stage, we regressed each endogenous variable on its leave-one-out instrument and covariates, using heteroskedasticity-consistent standard errors clustered at the product level. We then included the resulting residuals as controls in the second-stage regressions. In terms of relevance, as each review is written for a robopet, we argue that these reviews operate under similar conditions as the other reviews, making the instruments relevant. We further argue that the instruments meet exclusion restriction as we include reviews published after the focal

review, which were not available to the reviewers while writing their reviews. Accordingly, these instruments should not be correlated with the omitted variable related to strategic behavior.

3.5 Qualitative analyses

We complement the quantitative analyses with a qualitative analysis of review text to uncover the experiential dimensions of owning a robopet. This textual analysis involved systematic and iterative rounds of categorization, abstraction, comparison, and integration (Spiggle, 1994). Specifically, in alignment with our RQs, we grouped ways that interaction with the robopet (stimuli) induced various experiential responses from the beneficiary. Similar to Hoyer et al. (2020), who focus on the experiential dimensions most heavily affected by robots, we investigate the cognitive "think," emotional "feel," behavioral "act," and social "relate" responses (Schmitt, 1999) of the intended beneficiaries. These responses can potentially affect their vulnerability and well-being. To assess the benefactors' well-being, we focused on their emotional responses to giving the robopet to their elderly loved one. Our categorization emphasized positive emotional responses linked to hedonic well-being, such as subjective happiness and pleasure (Ryan & Deci, 2001).

Two of the authors developed the coding scheme through initial independent coding of a subset of online customer reviews, followed by discussions to reconcile any discrepancies and to refine code definitions. Observed agreement was high (92%). Any remaining discrepancies in coding were resolved through further discussions between the two coders, with any ambiguous cases adjudicated by referring to the definitions agreed on in the initial coding scheme.

4. Quantitative results

4.1. Regression models

Before presenting the results of regression models 1–5, we first analyze the correlations between the independent variables. Table 1 shows the descriptive statistics and correlations among the variables. The highest variance inflation factor for the independent and control variables across all the models is 2.71, suggesting no threat of multicollinearity. Table 2 shows the results of models 1–5.

Table 1
Correlations and descriptive statistics.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Ratings														
2. Realism	**0.176**	1.000												
3. Attachment	**0.255**	**0.088**	1.000											
4. Past pet ownership/love for animals	**0.150**	**0.098**	**0.091**	1.000										
5. Improved well-being	**0.577**	**0.146**	**0.385**	**0.205**	1.000									
6. Visual	-0.023	**0.196**	**-0.043**	-0.017	**-0.046**	1.000								
7. Tactile	**-0.110**	-0.018	**-0.128**	**-0.059**	**-0.140**	0.001	1.000							
8. Auditory	**-0.142**	**0.068**	**-0.108**	-0.031	**-0.140**	0.017	**0.044**	1.000						
9. Movement	**-0.226**	-0.008	**-0.128**	**-0.051**	**-0.210**	0.015	0.010	**0.258**	1.000					
10. Word count	-0.029	**0.186**	**0.080**	**0.258**	**0.107**	0.032	-0.018	**0.053**	**0.059**	1.000				
11. Concreteness	**-0.037**	-0.002	**-0.061**	**0.130**	**0.040**	-0.014	-0.004	-0.014	0.031	**0.229**	1.000			
12. Emotionality	**0.638**	**0.170**	**0.268**	**0.154**	**0.533**	-0.025	**-0.104**	**-0.129**	**-0.176**	**0.154**	**0.042**	1.000		
13. Position among reviews	-0.025	0.012	**0.049**	**-0.053**	-0.006	-0.002	0.000	0.007	**-0.078**	**-0.198**	**-0.173**	**-0.058**	1.000	
14. No. of images	0**.046**	0.025	**0.058**	**0.066**	0.014	0.032	-0.002	-0.015	**0.032**	**0.161**	-0.012	**0.069**	**-0.152**	1.000
Descriptive statistics (N = 3,693)														
M	4.438	0.264	0.451	0.206	0.761	0.008	0.013	0.014	0.008	59.98	1.656	0.684	1275.17	0.549
SD	1.15	0.441	0.498	0.405	0.426	0.018	0.027	0.026	0.017	62.186	0.364	0.448	1082.05	1.001

Notes: Significance is based on two-tailed tests. Correlations shown in bold are statistically significant at $p < .05$.

Table 2
Model estimates using control function approach.

	Model 1 DV: Perceived realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved well-being		Model 5 DV: Improved well-being	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Visual	21.459***	7.982								
Tactile	27.940**	14.102								
Auditory	18.834	19.511								
Movement	-0.253	13.747								
Realism			0.073***	0.011	0.034	0.023	0.410**	0.208	0.826	0.647
Attachment	0.351***	0.041	0.075***	0.004	0.012	0.017	1.529***	0.109	0.342	0.286
Past pet ownership/ love for animals	0.440***	0.056	0.050***	0.003	-0.041***	0.011	1.877***	0.166	0.922*	0.556
Realism × gifter					0.033*	0.019			-0.795	0.509
Realism × carer					-0.003	0.037			-0.406	0.289
Realism × self					0.121**	0.056			-0.183	0.585
Attachment × gifter					0.086***	0.017			2.057***	0.406
Attachment × carer					0.05***	0.015			0.681	0.726
Attachment × self					0.205***	0.021			0.720*	0.429
Past pet ownership/ love for animals × gifter					0.050**	0.023			1.520***	0.283
Past pet ownership/ love for animals × carer					0.029	0.018			0.187	0.207
Past pet ownership/ love for animals × self					0.169***	0.022			1.898***	0.161

Variable	Model 1 DV: Perceived realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved well-being		Model 5 DV: Improved well-being	
	Est.	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Reviewer type: gifter	0.409***	0.122	-0.034**	0.014	-0.082***	0.020	-0.844**	0.395	-1.04**	0.410
Reviewer type: carer	0.485***	0.151	-0.065***	0.011	-0.072***	0.011	0.085	0.215	0.177	0.127
Reviewer type: self	0.459***	0.061	-0.149***	0.008	-0.277***	0.018	-1.578***	0.192	-1.789***	0.140
Word count	0.005***	0.000	-0.001***	0.000	-0.001***	0.000	-0.002	0.002	-0.002	0.002
Concreteness	-0.304***	0.037	-0.031***	0.010	-0.040***	0.011	0.126	0.098	0.089	0.091
Emotionality	1.284***	0.076	0.506***	0.012	0.485***	0.015	2.181***	0.145	2.19***	0.147
Country: Canada	-0.769***	0.205	-0.024	0.020	-0.021	0.020	-0.341	0.248	-0.394	0.281
Country: United Kingdom	-0.272	0.181	-0.040	0.045	-0.037	0.041	-0.316**	0.145	-0.391**	0.180
Country: United States	-0.704***	0.069	-0.148***	0.044	-0.149***	0.050	-0.793*	0.423	-0.862*	0.447
Verified buyer	0.109*	0.062	-0.057	0.036	-0.062*	0.036	-0.418***	0.124	-0.429***	0.128
Position among reviews	0.000	0.000	0.000***	0.000	0.000***	0.000	0.000	0.000	0.000	0.000
No. of images	0.025	0.059	0.017***	0.005	0.016***	0.005	-0.088*	0.051	-0.091*	0.053
Beneficiary disability	0.095	0.078	0.029***	0.008	0.026***	0.008	0.592***	0.163	0.561***	0.162
Year fixed effects	Included		Included		Included		Included		Included	
Residuals of endogenous variables	Included		Included		Included		Included		Included	
Observations	3,693		3,693		3,693		3,693		3,693	

Notes: *** $p < .01$, ** $p < .05$, *$p < .10$. Significance is based on two-tailed tests. Realism, attachment, past pet ownership/love for animals, verified buyer, and beneficiary disability are dummy variables. Models 1, 4, and 5 use binary logistic regression (Firth's penalized likelihood); models 2 and 3 use linear regression. The reference categories for reviewer type, country, and year are healthcare professionals, Australia, and 2015, respectively. We use robust standard errors in our estimation to account for observations clustered along product lines. The first-stage regression results for the control function approach and estimates for the regression residuals are detailed in Appendix B.

Model 1 is a logistic regression model that estimates the correlates of perceived realism of robopets (in line with RQ1). The results indicate that visual (β = 21.459, $p = 0.007$) and tactile (β = 27.940, $p = 0.048$) cues are positively associated with realism of robopets. In contrast, auditory (β = 18.834, $p = 0.334$) and movement (β = –0.253, $p = 0.985$) cues do not show a significant association. In addition, those who feel stronger attachment to their robopet (β = 0.351, $p < 0.000$) and those who have previously owned real pets before or expressed a love for animals (β = 0.440, $p < 0.000$) are more likely to perceive higher levels of realism than their counterparts. Among the control variables, the number of words (β = 0.005, $p < 0.000$) and emotionality (β = 1.284, $p < 0.000$) have a positive association with realism, while concreteness (β = -0.304, $p < 0.000$) shows a negative association. Finally, reviewers from Canada (β = –0.769, $p < 0.000$) and the United States (β = –0.704, $p < 0.000$) are significantly more likely to perceive lower levels of realism than the reference category (those from Australia).

Linear regression models 2 and 3 estimate the association between review ratings and the covariates studied (as per RQ2). Model 2 shows that realism (β = 0.073, $p < 0.000$), attachment (β = 0.075, $p < 0.000$), and past pet ownership/love for animals (β = 0.050, $p < 0.000$) are positively associated with higher reviewer ratings. Furthermore, compared with healthcare professionals, gifters (β = –0.034, $p = 0.016$), carers (β = –0.065, $p < 0.000$), and self-reviewers (β = –0.149, $p < 0.000$) tend to assign lower ratings. Among the control variables, emotionality has a positive association with review ratings (β = 0.506, $p < 0.000$), while word count (β = –0.001, $p < 0.000$) and concreteness (β = –0.031, $p = 0.003$) show negative associations. Earlier reviews (β = 0.000, $p = 0.008$), reviews that include more images (β = 0.017, $p = 0.001$), and reviews mentioning that the beneficiary has a disability (β = 0.029, $p < 0.000$) tend to have higher positive ratings. Last, reviewers from the United States (β = –0.148, $p = 0.001$) are significantly more likely to give lower ratings than the reference category (those from Australia).

Model 3 tests the moderating effect of reviewer type on the influence of realism, perceived attachment, and past pet ownership/love for animals on review ratings. The results indicate that, compared with healthcare professionals, gifters assign marginally higher ratings (β = 0.033, $p = 0.086$) and self-reviewers assign significantly higher ratings (β = 0.121, $p = 0.031$) when they

perceive the robopet as realistic. Again, compared with healthcare professionals, review ratings tend to be higher for gifters (β = 0.086, $p < 0.000$), carers (β = 0.050, $p < 0.000$), and self-reviewers (β = 0.205, $p < 0.000$) when they become attached to the robopet. Finally, compared with healthcare professionals, review ratings tend to be higher for gifters (β = 0.050, $p = 0.023$) and self-reviewers (β = 0.169, $p < 0.000$) when they have prior pet ownership or express a love for animals.

In terms of the correlates of improved well-being (as per RQ3), model 4 reveals that realism (β = 0.410, $p = 0.049$), attachment (β = 1.529, $p < 0.000$), and past pet ownership/love for animals (β = 1.877, $p < 0.000$) are positively related to improved well-being. For reviewer type, gifters (β = –0.844, $p = 0.033$) and self-reviewers (β = –1.578, $p < 0.000$) are less likely to report well-being improvements than healthcare professionals. In addition, well-being uplift is more likely to be reported by beneficiaries who have some form of disability (β = 0.592, $p < 0.001$).

Finally, as model 5 indicates, all types of reviewers report statistically equivalent well-being in relation to realism. However, when compared with healthcare professionals, gifters report significantly higher well-being (β = 2.057, $p < 0.000$) and self-reviewers marginally higher well-being (β = 0.720, $p = 0.094$) in relation to perceived attachment. Last, both gifters (β = 1.520, $p < 0.000$) and self-reviewers (β = 1.898, $p < 0.000$) report higher well-being in relation to prior pet ownership/love for animals than healthcare professionals.

4.2. Robustness check

Following Sridhar et al. (2016), we remove product-level clustering to evaluate whether the original specification over-corrects for within-group variation. In its place, we used heteroskedasticity-consistent robust standard errors (Shao & Sun, 2021). The direction of the point estimates and significance levels for realism, attachment, and past pet ownership/love for animals remained unchanged in models 2 and 4, confirming that these focal relationships are not driven by over-correction for within-product dependence. However, in model 2, the marginally higher ratings assigned by gifters than by healthcare professionals to realism and prior pet ownership/love for animals became statistically equivalent under the alternative estimator. Furthermore, carers assign ratings to perceived attachment that are statistically equivalent to those of healthcare professionals. In model 5, self-reviewers report well-being statistically equivalent to healthcare professionals in terms

of attachment, as do gifters in relation to prior pet ownership/love for animals. Finally, the estimated effects of robopet features in model 1 exhibit greater sensitivity to the choice of variance–covariance estimator, with coefficients significant under product-level clustering losing significance under heteroskedasticity-consistent robust standard errors. This finding suggests that a meaningful portion of the explanatory power of sensory features operates at the product level and that product-level clustering more appropriately accounts for the resulting within-product correlation in reviewer perceptions of robopet realism (Petersen, 2009).

5. Qualitative findings

5.1. Beneficiary

Qualitative analysis of the review text indicated that although the beneficiaries of the robopet generally understood it was not a real animal (except those with advanced Alzheimer's disease), the robopet still helped reduce their vulnerability in several ways (as per RQ4). First, its animal-like characteristics and responses fostered the perception that it possessed intentions and could feel emotions, which provided beneficiaries with an opportunity for nurturance, giving them something for which to care. The following quote illustrates this point:

> The companion pet gives my Mom a sense of responsibility and satisfies her need to look after something. As she struggles with her daily life, having "Felix" has really allowed her to nurture and care and feel comfort and joy.

This opportunity to provide care was especially missed by previous pet owners:

> My Mom is 94 and an animal lover who is no longer able to care for a live pet. This was the best gift ever with the interactive personality, all the things it can do and the soft fur. I recommend this and would buy another one without hesitation. Great gift for an animal lover who cannot have a living pet!

Second, the robopet contributed to restoring a sense of agency for the beneficiary. It allowed them to make choices and decisions about the pet's name, what accessories it would have or wear, and when it should be brushed, remain awake, or be put to sleep (i.e., powered off). In this way, the beneficiary's "innate caregiving skills come to life … to nurture this cat." For example:

> I fell in love with it; I've already bought [the robopet] two collars, a pink and white bed, a larger brush, a tag in the shape of a paw with her name inscribed on it. I named my fur baby RAYNE.

Third, the robopet also elicited a positive social response by alleviating feelings of loneliness and serving as a social facilitator. It provided opportunities for connection with others, acting as a focal point for conversations, much like real dogs in promoting social integration in communities (Rijken & van Beek, 2011). For example, one caregiver shared how her mother enjoys telling engaging stories about her robopet's amusing behaviors to others.

Fourth, the robopet had a calming influence and served as a distraction, reducing symptoms of stress and anxiety, such as agitation, restlessness, fidgeting, pacing, and nighttime wandering. For example, one beneficiary who was coping with the grief of losing her real cat and adjusting to life in a nursing home found comfort and a sense of security in the Joy for All orange tabby cat amid all the transitions she faced. A caregiver also recounted how she previously relied heavily on medication to manage her mother's anxiety and agitation, but now she uses the robopet as a first option, resorting to medication only if the robopet is ineffective. This strategy has greatly reduced her mother's behavioral issues and dependence on medication.

However, while the reviews overwhelmingly indicated that the robopet improved the well-being of the intended beneficiary, this was not without associated risks. In some documented examples, beneficiaries found the robopet to be "creepy and wanted no part of it." Moreover, in cases in which beneficiaries developed a strong attachment to the robopet, significant distress occurred when the robopet's batteries required charging or replacement or when its operational mechanism simply stopped working. For example:

> But after a few months, it didn't respond. My Mom was so sad and blamed herself for not caring for the dog properly.
>
> Changed the batteries, but it still didn't work. Now my Mom is crying and depressed and wants to get it fixed but there's no place that fixes them. Waste of money. It's broken two months in.

These reviews raise important ethical considerations about the psychological implications and potential drawbacks of consumer dependency on such technologies. Table 3 summarizes the experiential responses of beneficiaries to robopets.

Table 3
Beneficiary experiential responses to robopets.

Beneficiary response		**Exemplary quotes**
Cognitive	Comfort	"She is so much calmer, and her carers find her so much easier to work with. Such a comfort to my mother." "Dealing with grief over the recent death of her cat and transitioning to a nursing home, the Joy for All orange tabby cat has provided comfort and even security with all the changes she is facing." "The cat has greatly helped Mom with her habit of worry face rubs and leg rubs, etc. and she always knows the cat is there, so is comforted and focuses on it." "Kitty had helped provide comfort and peace for my mom. Game changer for us!!"
	Alertness	"Helps to give him focus and stimulates him in a situation that lacks the opportunity to do that. Fun stimulation." "It definitely brought back a spark that we haven't seen in her in a while." "Since she received this cat, she has been more alert."
	Entertainment/ amusement	"It really amused her." "She loves interacting with the cat and it keeps her entertained." "Now I have something to entertain me." "She is so entertaining, and I cannot thank my family enough for getting her for me."
	Distraction	"Miss Kitty helps her get her mind off the pain, relax, and comfort her." "Helps reduce her pacing because she'll sit and pet the cat all day." "It keeps her busy and from having melt downs and helps her so much with her anxiety and depression." "The moment Mom was given her cat she began to pet and love her instead of scratching herself and pulling at her tubes."
	Sense of purpose	"Gives my [mother-in-law] a certain amount of responsibility that she's been missing." "Mom has all her faculties, and it just gives her something to 'take care of,' like shutting off Max when he becomes annoying." "She thinks she is taking care of the kitten, so it makes her happy." "This cat has given her purpose and something to take care of!!!"

Beneficiary response		**Exemplary quotes**
Emotional	Mood improver	“There is no more crying or being afraid at night anymore. This cat has made a massive difference in her life.” “I have never seen her so happy, the way she lights up every time I tell her this is her cat.” “She has bad mood swings where she’ll be upset about something but can’t articulate what’s wrong. This cat cheers her right up!”
	Social support	“It helped me when grieving my cat [who died] from cancer.” “It’s not a replacement for our kitty but it is helping us heal from our loss.” “He hasn’t smiled this much since he lost his buddy. I think it will be a huge help to him until he is ready to open up his heart again.”
	Joy/fun/laughter	“The joy this cat has brought and continues giving our mother brings us much joy!” “She really enjoys it. She talks to it and kisses it and laughs when it moves its head as if saying no.” “She is smiling from ear to ear and talking to it... Brought her much joy!”
	Reduced anxiety/stress	“It literally stopped her anxiousness and her pulling out IVs left and right.” “It has really calmed her down and eased the anxiety she had when she first moved into the assisted living facility.” “Her blood pressure was really high, and she needed something to keep her calm. This cat was the answer!” “I love how [robopet] calms her when she is feeling emotional, agitated or confused.”
Behavioral	Verbal response	“She talked to the cat for a good 11 hours straight.” “She had great difficulty speaking but would ask for baby every morning.” “Upon presentation her face lit up and she began to talk, something she has not done for some time.”
	Physical response	“She rocks and brushes and sings to it, takes it around to visit people in her retirement community, takes it to the doctor’s office with her.” “This little kitty has done what therapy and drugs could not – keep my wandering mother in her room at night!” “Most responsive I have seen her in a long time. Great rehab cat.” “Helps reduce her pacing because she’ll sit and pet the cat all day.”
Social	Companionship/friendship	“She takes it everywhere she goes; it rides along in her basket in her walker. This cat has become her true friend.”

Beneficiary response		Exemplary quotes
		“She feels less alone and abandoned, because the cat is always there for her.” “It does help with the loneliness.... I’m really enjoying having something to talk to besides myself.” “She takes it on car rides, away for the weekends, to functions and even in the carry basket of her walker when she goes to the shops! She talks to it and believes it answers her and even frets that it won’t eat.”
	Facilitates social engagement with others	“It supports social engagement; she shares it with her neighbors, and she also introduces it to her grandchildren to play with.” “She takes pictures of the kitty and texts them to me.” “My Mom gets lots of drop-ins from residents and even staff who all want to see the cat... She says it makes her feel less alone.” “The staff members spend a few more minutes with her when they come in because they converse about it, which makes her feel special.” “It also gives the carers, who treat it as a real kitten, something to talk about with her.”
	Belonging	“He has become a member of our family - Joy for all.” “She calls them her ‘family’ and greets them with ‘good morning’ each day to which they respond with a meow and a woof.” “Kitty is now a member of the family.”

5.2. Benefactor

When a loved one purchased a robopet for an older person, the main value derived was seeing improvements in the recipient's subjective happiness and pleasure (Ryan & Deci, 2001). The benefactors expressed a range of positive emotional responses related to this improved hedonic well-being. First, many benefactors reported feelings of gratitude, which is strongly associated with happiness (Watkins, 2004). Some described the robopet as a "blessing" or even a "Godsend" for their older loved one. They were grateful for the companionship the robopet provided and felt that it helped in "giving back life" to vulnerable loved ones, sharing sentiments such as the following:

> It was breaking my heart to see her so sad.... Such a blessing to find this product.... It has made such a difference in both of our lives. Thank you so much! LIFE-CHANGING product!

Second, benefactors expressed a range of positive emotions in their reviews, including joy, delight, happiness, excitement, and amazement. Joy appeared most frequently (79.7% of reviews), as many noted that the robopet enriched their loved ones' lives beyond expectations.[7] This positive impact often compelled them to recommend the product enthusiastically. For example, one heartfelt review captured the profound effect of the robopet on her life:

> If I could give this silly robocat a zillion stars I would!!! This cat has been a massive help.... The best and most meaningful purchase I've ever made on Amazon. I wholeheartedly recommend this cat for older folks with dementia. I couldn't be more delighted with it!

Third, some delighted benefactors referred to the robopet as "priceless" and "worth every penny," indicating that the benefits far outweighed the costs. Last, the robopet afforded comfort and relief to some benefactors as they felt reassured knowing it served as a daily companion for their otherwise lonely and isolated older loved one. Table 4 presents a summary of the hedonic emotional responses from benefactors.

[7] Frequency of joy in Amazon reviews was generated using the NRC Emotion Intensity Lexicon (https://nrc-publications.canada.ca/eng/view/object/?id=0b6a5b58-a656-49d3-ab3e-252050a7a88c). We filtered the original "joy" lexicon to retain only words with intensity scores above the median value, which resulted in a dictionary of 618 terms. We then applied this dictionary to the review text in R to identify the presence of joy words in each review.

Table 4
Hedonic value of robopet to benefactors.

Hedonic emotion	Definition	Exemplary quotes
Gratitude	Warm sense of appreciation and goodwill that an individual feels toward those from whom they have received help (McCullough et al., 2001).	"I haven't seen my Mom smile like this in two years! Thank you!!!" "From the bottom of my heart thank you. Answer to prayers!" "What a blessing this has been.... How can I ever express how much joy it brings him? I can't recommend it enough and our entire family is full of gratitude." "The money for Ginger was the best money I have ever spent. Thank you very much. I am so grateful that that this cat has helped."
Joy	A positive emotional response to a "good," hoped for, and better-than-expected event; some kind of triumph after all seemed lost (Watkins et al., 2018).	"We have been more than pleased with the joy that it has given all of us. It has been a joy to see my mom play with it. This is so worth the smiles and giggles we heard." "It made me cry to see her face light up when she saw the cat move! It is pure joy!!" "It's a joy for me to see the comfort this robotic cat has given my Mom and keeps her company."
Delight	A profoundly positive emotional state generally resulting from having one's expectations exceeded to a surprising degree (Oliver, 1997).	"What a delight it was for me to see her reaction to this adorable kitty." "They told me how happy my Grandma got when they brought it out to her THAT is worth all the money in the world. To see her smile and enjoy this cat is worth every penny." "It was the BEST gift we could have asked for a glimpse into our mom again! It brings a smile to her face, which we didn't think we would ever see again!"
Happiness	Frequent positive emotions, infrequent negative emotions; often associated with the experience of joy, contentment, and a meaningful life (Hellén & Sääksjärvi, 2011).	"I am not generally a super sensitive guy, but 'wow' it brought a tear and great joy to me to see how it has affected one woman who I care so much about. And to us, her children, it gives us happiness knowing the joy she experiences while holding her cat." "My mother loves her, so that makes me VERY HAPPY." Wow, wow, wow! I am so happy. The look on his face is priceless!" "Very happy over her reaction and I would definitely recommend this product to anyone."
Satisfaction	Comparison between perceived outcomes and expectations and when evaluations meet or exceed	"Completely satisfied with my purchase." "All it says it is!" "It works better than medicine on many occasions. Quality product."

Hedonic emotion	Definition	Exemplary quotes
	expectations, satisfaction is experienced (Oliver, 1997).	"The cat was beautiful, and it did what they say it would."
Thrilled	A positive emotion related to excitement and exhilaration (Buckley, 2016).	"I am so thrilled this cat was such a hit." "It is a wonderful companion, and I am so thrilled she is now contented." "We are thrilled to provide her with a companion she can relate to."
Amazed	A feeling of great surprise or wonder (Filieri et al., 2022).	"I haven't seen my grandmother that happy since before she became sick. Amazing, simply amazing." "The joy it brings is amazing." "This is the best for him. This cat is amazing." "Amazing product, Dad loves her!"
Comfort	A sense of ease that facilitates calm and worry-free feelings (Ainsworth & Foster, 2017).	"It fills my heart with so much warmth to know how endeared she is to it, with a smile across her face that would melt your heart. I know there's something that can express love to her. Maybe she won't feel lonely and isolated as much? Truly a comfort." "It gives us great comfort knowing it does the same for her." "I feel like she has some company when she is alone, which is super comforting." "To see her enjoying the companionship of having a cat means the world to me." "I also wanted her to have something that would respond to her and be a daily companion.... It is comforting to me to know that she has 'someone' to talk to and keep her company."
Relief	A positive emotion underpinned by the cessation of fear or by the cessation of a negative experience (Graham et al., 2023).	"It's the best gift she ever received.... This toy has been a real lifesaver!" "I was really worried that my sister, who has had cats her whole life, was at risk of sinking into a bad depression after all she has been through." "This cat has been a lifesaver for her and us as caregivers."

6. Discussion

Our quantitative study shows how specific sensory cues and individual characteristics shape the way older adults perceive and respond to robopets over extended use. First, it reveals robopet features that drive realism. This finding challenges the notion of uniform multi-sensory salience, which assumes that all sensory inputs contribute equally to a user's experience. For example, while existing literature often considers touch and movement equally critical to realism (e.g., Dautenhahn, 2007), our findings indicate that a robopet's appearance and tactile feel matter more than its sound and movement patterns. Furthermore, we show that those who previously owned pets or have a love for animals may perceive robopets as more realistic. This finding validates our understanding of zoomorphism, or the "attribution of animal traits to human beings, deities, or inanimate objects" (VandenBos, 2007, p. 1011). Past experience with real animals may make zoomorphic knowledge more accessible; that is, users who have owned pets are likely more attuned to design elements that emulate a living creature. Second, their inherent motivation to understand and predict animal behaviors may lead them to interpret a robopet's responses as intentional and lifelike. Finally, for those accustomed to regular animal companionship, the persistent desire for such connection may further drive the tendency to attribute real-life qualities to a machine.

Our qualitative analysis demonstrates how robopets can enhance the well-being of those experiencing both primary and secondary vulnerability. Changes in roles can threaten people's identity, making them feel more passive and powerless (Sudbury-Riley et al., 2024). Our findings suggest that robopets can help restore or protect the identity of older individuals who are no longer able to care for a pet but strongly identify as an animal lover. Furthermore, the possession of a robopet enables vulnerable beneficiaries to regain a sense of control, as they are able to make own choices about, for example, what the robopet is called, its grooming needs, and more. Indeed, in some cases, people may exert greater control over the robopet than over other interpersonal resources they had lost (e.g., social networks). As the freedom to choose is essential to human well-being (Bone et al., 2014), robopets can help restore the ability to choose and, thus, the beneficiary's sense of agency and being.

Like live pets, robopets provide beneficiaries with a sense of being needed, a focus for their attention, and a means to reestablish a daily routine. Robopets help build social connections between

beneficiaries and their peers (e.g., other aged care residents) and caregivers, including staff and family members. Our findings suggest that robopets play a major role in helping beneficiaries restore their sense of self by improving their self-esteem, self-efficacy, and self-autonomy. This, in turn, helps alleviate feelings of loneliness, anxiety, and depression.

Moreover, in line with Hermann et al.'s (2024) argument, our findings suggest that robopets can empower secondary vulnerable consumers to better support primary vulnerable consumers, lighten their burdens, and increase their own hedonic well-being. Benefactors reported a range of positive emotions in their reviews, such as joy, delight, and gratitude, when they observed the positive effects of the robopet on their older loved ones. Observing their loved ones feeling happier, more comfortable, and/or less lonely because of the robopet was often a source of comfort and support. Ultimately, witnessing their loved one's happiness while interacting with the robopet contributed to an uplift in their own hedonic well-being.

6.1. Theoretical contributions

First, we extend work on attachment theory (Ainsworth & Bowlby, 1991), or the idea that people need a reliable source of comfort and security; this applies to the relationship between older adults and robopets. Our findings reveal that realism, attachment, and past pet ownership/love for animals each significantly predict both user ratings and improvements in well-being. For satisfaction ratings, realism and attachment contribute almost equally, suggesting that both zoomorphism and attachment matter for overall satisfaction. For well-being, the balance shifts: attachment and past pet ownership/love for animals carry more weight than realism. These findings expand the conversation about designing robopets for older adults, emphasizing the need to consider not only technical design but also the psychological characteristics and personal history of users.

Second, we contribute to the emerging literature on secondary vulnerability (Carlini et al., 2026; Leino et al., 2021) by considering the nuanced effect of reviewer type on ratings and well-being. For satisfaction ratings, attachment produces significantly stronger effects for gifters, carers, and self-reviewers than for healthcare professionals. Past pet ownership similarly produces stronger effects on ratings for gifters and self-reviewers than for healthcare professionals, but carers do not differ significantly from the professional baseline. Robopet realism improves ratings more for gifters

and self-reviewers than for healthcare professionals, while carers again show no significant difference. For well-being, realism provides no significantly different benefits for any user group compared with healthcare professionals. Attachment and past pet ownership, by contrast, generate significantly greater well-being improvements for gifters and self-reviewers than for healthcare professionals, while carers again do not differ significantly from the professional baseline. Table 5 provides a summary of these insights.

6.2. Managerial implications

Information from online customer reviews can greatly benefit marketers by helping them "listen to" customer sentiments and identify opportunities to facilitate and communicate intended value (Balducci & Marinova, 2018). Our findings indicate that the visual and auditory attributes of robopets influence how realistic beneficiaries perceive them to be, which presents critical considerations for designers. Designers need to strike a careful balance between technological capabilities and customer expectations, paying particular attention to appropriate vocalizations and aesthetic features of robopets that enhance realism while avoiding the uncanny valley effect (i.e., when robopets look and move almost—but not quite—like real pets, provoking a feeling of unease or revulsion, rather than growing affinity expected as realism increases) (Löffler et al., 2020).

Our findings also suggest that experienced vulnerability and associated insecurity and anxiety can be alleviated by encouraging beneficiaries to take ownership of and care for their robopets. Marketers can support this initiative by promoting the idea of individual ownership, suggesting that each robopet should be given a unique name, can be trained through AI to respond to the beneficiary's voice commands, and can be accessorized with a range of pet clothing and other items for personal expression (e.g., collars, blankets, beds). A review of robopets currently available on the market indicates that while there are various options for pet type (e.g., cat, dog, bird) and colors, there is a noticeable lack of accessories.

Table 5
Summarization and implications based on regression results.

Reviewer type and strategy	Realism → rating	Attachment → rating	Past pet ownership / love for animals → rating	Realism → well-being	Attachment → well-being	Past pet ownership / love for animals → well-being
Healthcare professional	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Gifter	0.033*	0.086***	0.050**	-0.795	2.057***	1.520***
Carer	-0.003	0.050***	0.029	-0.406	0.681	0.187
Self	0.121**	0.205***	0.169***	-0.183	0.720*	1.898***
Possible marketing strategy	Invest in visual and tactile robopet features and highlight these prominently in marketing communications targeting gifters and self-reviewers.	Emphasize companionship and emotional connection with robopets across all marketing communications.	Specifically target older adults with a history of pet ownership and family members buying for them, framing robopet ownership as a meaningful continuation of a lifelong bond with animals.	Avoid positioning technical realism as a well-being benefit.	Center well-being messaging on the emotional bond users will experience, particularly when targeting family members purchasing the device on behalf of an older adult loved one.	Specifically target older adults with a history of pet ownership and family members buying for them, framing robopet ownership as a meaningful continuation of a lifelong bond with animals.

Notes: *** $p < .01$, ** $p < .05$, *$p < .10$. Significance is based on two-tailed tests.

In addition, many robopets come with pre-determined names (e.g., "Spencer the Golden Retriever"), and some of the more expensive models even feature a set of pre-defined voice commands that include their names, such as "metaCat[8]" to wake up the robotic cat. Empowering beneficiaries to choose a name for their robopet and select their accessories will not only enhance feelings of pet ownership but also provide a greater sense of agency and control, which will go a long way toward reducing their vulnerability and enhancing their overall well-being. Furthermore, personal ownership can mitigate the risk of infection spread from shared use of robopets, which is a common concern in residential care settings (Koh et al., 2022).

Furthermore, the reviews indicated that breakdown of the robopet was inevitable, with some noting that malfunctions sometimes occurred shortly after the beneficiary received the robopet (e.g., "movement stopped after two months"). Just like the distress associated with the death or loss of a real pet (Sharkin & Knox, 2003), a deep attachment to a robopet will likely have a strong negative impact on the beneficiary's well-being. Some carer reviewers spoke about the need to purchase multiple robopets because they could not bear to witness their loved one suffering again. However, given the high cost of the robopet, this practice was not sustainable. Robopet manufacturers need to be aware of the potential negative impact on the vulnerable individual of the "sudden death" of their robopet, as the loss of a robopet may ignite memories of past losses and make personal mortality more salient for older people, which can compound their sadness and loneliness (Sharkin & Knox, 2003). Therefore, robopet manufacturers need to invest in making the product more durable, extending the warranty period (currently 60 days; Ageless Innovation, 2024b), or at least facilitating repairs.

Finally, product developers need to recognize that when targeting vulnerable users, secondary vulnerable companions may exist. Organizations thus need to understand and cater to the needs of both consumer groups (Leino et al., 2021). Targeting strategies could include focusing on the loved ones of the elderly (e.g., adult children, partners) during seasonal gift-giving occasions (e.g., Christmas). Furthermore, given our finding that uplifted hedonic well-being is the primary value that secondary vulnerable consumers derive from their purchase, marketing communications could

[8] https://www.amazon.com.au/ELEPHANT-ROBOTICS-Companion-Interactive-Electronic/dp/B0BXCCZGM8.

emphasize positive emotional testimonials. This can include, for example, visual evidence and testimonials from family members about moments of joy and gratitude when their loved ones bond with their robopet. This approach contrasts with the current marketing communication practices of robopet suppliers, which predominantly focus on the intended beneficiary.

6.3. Limitations and future research

This study has several data limitations that need to be acknowledged. First, we focused on robopets from Joy for All, a leading brand specifically designed for older adults, but consumers may also use non-specialized alternatives, such as Perfect Petzzz. Including data from general-purpose robopets could reveal how older users adapt these products and clarify the well-being implications, thereby enhancing the generalizability of our findings. Second, our data collection was limited to reviews from Amazon. Although Amazon is the most popular e-commerce platform and predominant data source in marketing research on online reviews (Boegershausen et al., 2022), using a single platform may introduce bias as consumer experiences and reviewing behavior could vary across different platforms. Future research could integrate more diverse data sources, such as interviews, focus groups, and surveys of robopet owners, alongside an analysis of newspaper articles and blogs. Third, our analysis was also limited to text and numeric ratings. While we controlled for the number of images included in the reviews, we did not process the images posted by reviewers. Future studies could manually process images or leverage automated classification models (Hartmann et al., 2021) to identify further nuances in robopet usage and their effects on beneficiaries. Last, our findings are limited to older adults in a Western context, but they may have relevance for other populations experiencing vulnerability, such as young adults facing loneliness or those with disabilities, who may also face barriers to live pet ownership. Future research could thus explore how the dynamics of gifting, self-purchase, and caregiving manifest across different age groups and cultural contexts.

While robopets can successfully reduce both primary and secondary vulnerability, they should be viewed as part of a therapeutic toolbox (Birks et al., 2016) to aid communication, entertainment, and perceptions of control, not as a panacea. Future research could explore the efficacy of robopets compared with other forms of social or recreational therapy for older adults.

Furthermore, our research is agnostic to the ethical challenges involved in the use of robopets by older people who may experience cognitive impairment and/or loneliness. For example, older adults with dementia may need to be reminded that robopets are machines rather than real pets (Hung et al., 2025), as strong attachment and dependence can arise. Another risk is that the robopet may be used as a substitute for human interaction and caregiving, particularly in under-resourced aged care facilities. One reviewer indicated that their loved one now "spends hours in her chair at her assisted living facility stroking and combing [the robopet]." While we found no comments indicating a reduced need for family visits due to the introduction of robopets, caregiver reviewers expressed their gratitude and relief, with one noting that the robopet "will keep [her mother] company in the nursing home since I can't visit her daily." Therefore, future research might track whether these AI interventions reduce the actual time that older people spend interacting with other humans, such as aged care staff and/or family members, even though our findings would suggest that robopets act as a catalyst for increased social engagement. Overall, these potential unintended, negative consequences of robopets warrant more careful consideration (Heirati et al., 2025) in a comprehensive study of the consumer harms associated with robopets.

References

Abbott, R., Orr, N., McGill, P., Whear, R., Bethel, A., Garside, R., Stein, K. & Thompson-Coon, J. (2019). How do "robopets" impact the health and well-being of residents in care homes? A systematic review of qualitative and quantitative evidence. *International Journal of Older People Nursing, 14*(3), 122-139.

Ageless Innovation (2024a). Play has no age limit! Retrieved February 1, 2026, from https://joyforall.com/?srsltid=AfmBOoqL9txmW6O5PBdLzjfAmGMpIFlKf3e3HXkoELlq2LgpwdNWouke.

Ageless Innovation (2024b). Return policy. Retrieved April 22, 2025, from https://joyforall.com/pages/return-policy.

Ahmed, E., Buruk, O. & Hamari, J. (2024). Human–robot companionship: Current trends and future agenda. *International Journal of Social Robotics,* 16, 1809-1860.

Ainsworth, M. D. S., & Bowlby, J. (1991). An ethological approach to personality development. *American Psychologist, 46*, 331-341.

Ainsworth, J., & Foster, J. (2017). Comfort in brick-and-mortar shopping experiences: Examining antecedents and consequences of comfortable retail experiences. *Journal of Retailing and Consumer Services*, *35*, 27-35.

Amazon. (2025). Amazon's latest actions against fake review brokers: Amazon and BBB join forces again to combat fake reviews. Retrieved January 21, 2026, from https://www.aboutamazon.com/news/policy-news-views/amazons-latest-actions-against-fake-review-brokers.

Baker, S. M., Gentry, J. W., & Rittenburg, T. L. (2005). Building understanding of the domain of consumer vulnerability. *Journal of Macromarketing*, *25*(2), 128-139.

Balducci, B., & Marinova, D. (2018). Unstructured data in marketing. *Journal of the Academy of Marketing Science*, *46*, 557-590.

Banks, M. R., Willoughby, L. M., & Banks, W. A. (2008). Animal-assisted therapy and loneliness in nursing homes: Use of robotic versus living dogs. *Journal of the American Medical Directors Association*, *9*(3), 173-177.

Benoit, K., Watanabe, K., Wang, H., Nulty, P., Obeng, A., Müller, S., & Matsuo, A. (2018). quanteda: An R package for the quantitative analysis of textual data. *Journal of Open Source Software, 3*(30), 774. https://doi.org/10.21105/joss.00774

Berg, H., & Liljedal, K. T. (2022). Elderly consumers in marketing research: A systematic literature review and directions for future research. *International Journal of Consumer Studies, 46*(5), 1640-1664.

Birks, M., Bodak, M., Barlas, J., Harwood, J., & Pether, M. (2016). Robotic seals as therapeutic tools in an aged care facility: A qualitative study. *Journal of Aging Research*, (1), 8569602.

Boegershausen, J., Datta, H., Borah, A., & Stephen, A. T. (2022). Fields of gold: Scraping Web data for marketing insights. *Journal of Marketing*, *86*(5), 1-20.

Bone, S. A., Christensen, G. L., & Williams, J. D. (2014). Rejected, shackled, and alone: The impact of systemic restricted choice on minority consumers' construction of self. *Journal of Consumer Research*, *41*(2), 451-474.

Bradwell, H. L., Edwards, K., Shenton, D., Winnington, R., Thill, S., & Jones, R. B. (2021). User-centered design of companion robot pets involving care home resident-robot interactions and focus groups with residents, staff, and family: Qualitative study. *JMIR Rehabilitation and Assistive Technologies*, *8*(4), e30337.

Brooks, H. L., Rushton, K., Lovell, K., Bee, P., Walker, L., Grant, L., & Rogers, A. (2018). The power of support from companion animals for people living with mental health problems: A systematic review and narrative synthesis of the evidence. *BMC Psychiatry*, *18*, 1-12.

Brysbaert, M., Warriner, A. B., & Kuperman, V. (2014). Concreteness ratings for 40 thousand generally known English word lemmas. *Behavior Research Methods, 46*(3), 904-911.

Buckley, R. C. (2016). Qualitative analysis of emotions: Fear and thrill. *Frontiers in Psychology, 7*, 1187.

Carlini, J., Riedel, A., Lehman, K., & Ranse, K. (2026). Transformative service in healthcare: Understanding secondary vulnerability and coping mechanisms in end-of-life care. *Journal of Service Theory and Practice, 36*(1), 23–44.

Chiu, C. J., Hsieh, S., & Li, C. W. (2021). Needs and preferences of middle-aged and older adults in Taiwan for companion robots and pets: Survey study. *Journal of Medical Internet Research, 23*(6), 23471.

Dang, N. B., & Bertrandias, L. (2025). Beyond companionship: Exploring the role of social robots in mitigating emotional and social loneliness of the elderly. *Journal of Macromarketing*, *45*(4), 612-631.

Dautenhahn, K. (2007). Socially intelligent robots: Dimensions of human–robot interaction. *Philosophical Transactions of the Royal Society B: Biological Sciences, 362*(1480), 679-704.

Del Bucchia, C. D., Lancelot Miltgen, C., Russell, C. A., & Burlat, C. (2021). Empowerment as latent vulnerability in techno-mediated consumption journeys. *Journal of Business Research*, *124*, 629-651.

Dzyabura, D., & Peres, R. (2021). Visual elicitation of brand perception. *Journal of Marketing*, *85*(4)*,* 44-66.

Fan, W., Zhao, R., Liu, X., & Ge, L. (2025). Intelligent robot interventions for people with Dementia: Systematic review and meta-analysis of randomized controlled trials. *Journal of Medical Internet Research, 27*, e59892.

Filieri, R., Lin, Z., Li, Y., Lu, X., & Yang, X. (2022). Customer emotions in service robot encounters: A hybrid machine-human intelligence approach. *Journal of Service Research*, *25*(4), 614-629.

Fletcher-Brown, J., Turnbull, S., Viglia, G., Chen, T., & Pereira, V. (2021). Vulnerable consumer engagement: How corporate social media can facilitate the replenishment of depleted resources. *International Journal of Research in Marketing*, *38*(2), 518-529.

Glavas, C., Letheren, K., Russell-Bennett, R., McAndrew, R., & Bedggood, R. E. (2020). Exploring the resources associated with consumer vulnerability: Designing nuanced retail hardship programs. *Journal of Retailing and Consumer Services, 57*, 102212. https://doi.org/10.1016/j.jretconser.2020.102212.

Graham, A. J., McCormack, T., Lorimer, S., Hoerl, C., Beck, S. R., Johnston, M., & Feeney, A. (2023). Relief in everyday life. *Emotion, 23*(7), 1844-1868.

Hajek, P., Hikkerova, L., & Sahut, J.-M. (2023). Fake review detection in e-Commerce platforms using aspect-based sentiment analysis. *Journal of Business Research*, *167*, 114143. https://doi.org/10.1016/j.jbusres.2023.114143

Hartmann, J., Heitmann, M., Schamp, C., & Netzer, O. (2021). The power of brand selfies. *Journal of Marketing Research, 58*(6), 1159–1177. https://doi.org/10.1177/00222437211037258

Heirati, N., Pitardi, V., Wirtz, J., Jayawardhena, C., Kunz, W., & Paluch, S. (2025). Unintended consequences of service robots – Recent progress and future research directions. *Journal of Business Research*, *194*, 115366.

Hellén, K., & Sääksjärvi, M. (2011). Happiness as a predictor of service quality and commitment for utilitarian and hedonic services. *Psychology & Marketing, 28*(9), 934-957.

Herhausen, D., Ludwig, S., Grewal, D., Wulf, J., & Schoegel, M. (2019). Detecting, preventing, and mitigating online firestorms in brand communities. *Journal of Marketing*, *83*(3), 1-21. https://doi.org/10.1177/0022242918822300

Hermann, E., Williams, G. Y., & Puntoni, S. (2024). Deploying artificial intelligence in services to AID vulnerable consumers. *Journal of the Academy of Marketing Science, 52*(5), 1431-1451.

Hill, R. P., & Sharma, E. (2020). Consumer vulnerability. *Journal of Consumer Psychology*, *30*(3), 551-570.

Hofstede, G. (2011). Dimensionalizing cultures: The Hofstede model in context. *Online Readings in Psychology and Culture, 2*(1), https://doi.org/10.9707/2307-0919.1014

Hoyer, W. D., Kroschke, M., Schmitt, B., Kraume, K., & Shankar, V. (2020). Transforming the customer experience through new technologies. *Journal of Interactive Marketing*, *51*(1), 57-71.

Huang, G., & Oteng, S. A. (2023). Gerontechnology for better elderly care and life quality: A systematic literature review. *European Journal of Ageing, 20*(1), 27.

Hung, L., Mann, J., Perry, J., Berndt, A., & Wong, J. (2022). Technological risks and ethical implications of using robots in long-term care. *Journal of Rehabilitation and Assistive Technologies Engineering*, *9*, 20556683221106917.

Hung, L., Zhao, Y., Alfares, H., & Shafiekhani, P. (2025). Ethical considerations in the use of social robots for supporting mental health and wellbeing in older adults in long-term care. *Frontiers in Robotics and AI*, *12*, 1560214.

Hutto, C., & Gilbert, E. (2014). VADER: A parsimonious rule-based model for sentiment analysis of social media text. *Proceedings of the International AAAI Conference on Web and Social Media*, *8*(1), 216-225.

Ihamäki, P., & Heljakka, K. (2024). Robot pets as "serious toys" – Activating social and emotional experiences of elderly people. *Information Systems Frontiers*, *26*(1), 25-39.

Iyengar, R., Van Den Bulte, C., & Valente, T. W. (2011). Opinion leadership and social contagion in new product diffusion. *Marketing Science, 30*(2), 195-212. https://doi.org/10.1287/mksc.1100.0566

Jiang, C., Yin, C., Tang, Q., & Wang, Z. (2023). The value of official website information in the credit risk evaluation of SMEs. *Journal of Business Research, 169*, 114290. https://doi.org/10.1016/j.jbusres.2023.114290

Kipnis, E., McLeay, F., Grimes, A., de Saille, S., & Potter, S. (2022). Service robots in long-term care: A consumer-centric view. *Journal of Service Research*, *25(4)*, 667-685.

Koh, W. Q., Ang, F. X. H., & Casey, D. (2021). Impacts of low-cost robotic pets for older adults and people with Dementia: Scoping review. *JMIR Rehabilitation Assistive Technology*. *8*(1): e25340.

Lai, N. M., Chang, S. M. W., Ng, S. S., Tan, S. L., Chaiyakunapruk, N., & Stanaway, F. (2019). Animal-assisted therapy for dementia. *Cochrane Database of Systematic Reviews*, *11*, CD013243.

The Lancet (2024). Caring for our invisible older carers. *The Lancet Healthy Longevity, 5*(11), 100662.

Lazarus, R.S., & Folkman, S. (1984). *Stress, Appraisal, and Coping.* New York: Springer.

Leino, H. M., Hurmerinta, L., & Sandberg, B. (2021). Balancing service inclusion for primary and secondary customers experiencing vulnerabilities. *Journal of Services Marketing*, *35*(6), 692-705.

Liu, P. J., Dallas, S. K., & Fitzsimons, G. J. (2019). A framework for understanding consumer choices for others. *Journal of Consumer Research*, *46*(3), 407-434.

Liu, Y., Ott, M., Goyal, N., Du, J., Joshi, M., Chen, D., Levy, O., Lewis, M., Zettlemoyer, L., & Stoyanov, V. (2019). RoBERTa: A robustly optimized BERT pretraining approach. arXiv:1907.11692.

Löffler, D., Dörrenbächer, J., & Hassenzahl, Marc. (2020). The uncanny valley effect in zoomorphic robots: The u-shaped relation between animal likeness and likeability. 261-270.

Ludwig, S., Herhausen, D., Grewal, D., Bove, L., Benoit, S., de Ruyter, K., & Urwin, P. (2022). Communication in the gig economy: Buying and selling in online freelance marketplaces. *Journal of Marketing*, *86*(4), 141-161.

Martins, C. F., Soares, J. P., Cortinhas, A., Silva, L., Cardoso, L., Pires, M. A., & Mota, M. P. (2023). Pet's influence on humans' daily physical activity and mental health: A meta-analysis. *Frontiers in Public Health*, *11*, 1196199.

McColgan, G., & Schofield, I. (2007). The importance of companion animal relationships in the lives of older people. *Nursing Older People*, *19*(1), 21–23.

McCullough, M. E., Kilpatrick, S. D., Emmons, R. A., & Larson, D. B. (2001). Is gratitude a moral affect? *Psychological Bulletin, 127*(2), 249–266.

McDaniel, L., Essien, I., Lefcourt, S., Zelleke, E., Sinha, A., Chellappa, R., & Abadir, P.M. (2025). Aging with artificial intelligence: How technology enhances older adults' health and independence. *Journal of Gerontology Series A: Biological Sciences and Medical Sciences, 80*(7)*,* glaf086.

Meng, C., Sandoval, E., Sosa, R. & Cruz, F. (2025). Towards senior-robot interaction: Reactive robot dog gestures. 10.48550/arXiv.2512.17136.

Moyle, W., Jones, C., Murfield, J., Thalib, L., Beattie, E., Shum, D., & Draper, B. (2019). Using a therapeutic companion robot for dementia symptoms in long-term care: Reflections from a cluster-RCT. *Aging & Mental Health*, *23*(3), 329-336.

Murayama, H., & Takase, M. (2025). Effect of social robots in reducing loneliness among community-dwelling older adults: A mixed-method approach. *Innovation in Aging, 9*(Supplement_2), igaf122.3049. https://doi.org/10.1093/geroni/igaf122.3049

New York State Office for the Aging (n.d.). NYSOFA's animatronic pet initiative. Retrieved April 21, 2025, from https://aging.ny.gov/nysofa-animatronic-pet-initiative.

Oliver, R. L. (1997). *Satisfaction: A behavioral perspective on the consumer*. McGraw-Hill.

O'Loughlin, D., Gummerus, J., & Kelleher, C. (2024). It never ends: Vulnerable consumers' experiences of persistent liminality and resource (mis) integration. *Journal of Service Research*, *27*(3), 327-345.

Ong, W. L., Wee, S. L., & Yap, P. L. K. (2022). The usability and impact of a low-cost pet robot for older adults and people with dementia: Qualitative content analysis of online consumer reviews. *JMIR Aging, 5*(1), e29224.

Pavia, T. M., & Mason, M. J. (2014). Vulnerability and physical, cognitive, and behavioral impairment: Model extensions and open questions. *Journal of Macromarketing*, *34*(4), 471-485.

Peng, L., Cui, G., Chung, Y., & Zheng, W. (2020). The faces of success: Beauty and ugliness premiums in e-commerce platforms. *Journal of Marketing*, *84*(4), 67-85.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*(1), 435-480.

Petrin, A., & Train, K. (2010). A control function approach to endogeneity in consumer choice models. *Journal of Marketing Research, 47*(1), 3–13.

Pu, L., Moyle, W., Jones, C., & Todorovic, M. (2019). The effectiveness of social robots for older adults: A systematic review and meta-analysis of randomized controlled studies. *The Gerontologist*, *59*(1), 37-51.

RexFacts (2025). Friendly and futuristic: How robots are changing life in aged care. Retrieved February 20, 2026, from https://www.agedcareguide.com.au/talking-aged-care/friendly-and-futuristic-how-robots-are-changing-life-in-aged-care.

Riedel, A., Messenger, D., Fleischman, D., & Mulcahy, R. (2021). Consumers experiencing vulnerability: A state of play in the literature. *Journal of Services Marketing*, *36*(2), 110-128.

Rijken, M. & van Beek, S. (2011). About cats and dogs… Reconsidering the relationship between pet ownership and health related outcomes in community-dwelling elderly. *Social Indicators Research*, *102*, 373-388.

Robinson, H., MacDonald, B., & Broadbent E. (2015). Physiological effects of a companion robot on blood pressure of older people in residential care facility: A pilot study. *Australas J Ageing, 34*(1), 27-32.

Rocklage, M. D., Rucker, D. D., & Nordgren, L. F. (2018). Persuasion, emotion, and language: The intent to persuade transforms language via emotionality. *Psychological Science*, *29*(5), 749-760.

Ross, C. B., & Baron-Sorensen, J. (1998). *Pet loss and human emotion: Guiding clients through grief*. Accelerated Development.

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52,* 141-166.

Sandberg, B., Leila, H., Leino, H. & Menzfeld M. (2022). Autonomy or security? Core value trade-offs and spillovers in servicescapes for vulnerable customers. *Journal of Service Research*, *25*(1), 9-28.

Schmitt, B. (1999). Experiential marketing. *Journal of Marketing Management*, *15*(1/3), 53-67.

Shao, Y., & Sun, L. (2021). Entrepreneurs' social capital and venture capital financing. *Journal of Business Research*, *136*, 499-512.

Sharkin, B. S., & Knox, D. (2003). Pet loss: Issues and implications for the psychologist. *Professional Psychology: Research and Practice*, *34*(4), 414-421.

Speering, H., & Speering, L. (2021). A proposed model of dehumanization and its relevance to dehumanization in dementia care. Preprints. https://doi.org/10.20944/preprints202101.0147.v1

Spiggle, S. (1994). Analysis and interpretation of qualitative data in consumer research. *Journal of Consumer Research*, *21*(3), 491-503.

Sridhar, S., Germann, F., Kang, C., & Grewal, R. (2016). Relating online, regional, and national advertising to firm value. *Journal of Marketing, 80*(4), 39–55. https://doi.org/10.1509/jm.14.0231

Sudbury-Riley, L., Hunter-Jones, P., Al-Abdin, A., & Haenlein, M. (2024). When the road is rocky: Investigating the role of vulnerability in consumer journeys. *Journal of the Academy of Marketing Science*, *52*(4), 1045-1068.

Swarts, K. (2023, July 13). Not just for kids anymore: Joy for All robotic companion pets for seniors. *BridgingApps*. https://bridgingapps.org/not-just-for-kids-anymore-joy-for-all-robotic-companion-pets-for-seniors/.

VandenBos, G.R. (2007). *APA dictionary of psychology*. American Psychological Association.

Wang, F., Du, Z., & Wang, S. (2023). Information multidimensionality in online customer reviews. *Journal of Business Research, 159*, 113727. https://doi.org/10.1016/j.jbusres.2023.113727

Watkins, P. C. (2024). Gratitude and subjective well-being. In R.A. Emmons & M.E. McCullough (Eds.), *The psychology of gratitude* (pp. 167-192). Oxford University Press.

Watkins, P. C., Emmons, R. A., Greaves, M. R., & Bell, J. (2018). Joy is a distinct positive emotion: Assessment of joy and relationship to gratitude and well-being. *Journal of Positive Psychology, 13*(5), 522–539.

Weber-Guskar, E. (2021). How to feel about emotionalized artificial intelligence? When robot pets, holograms, and chatbots become affective partners. *Ethics Information Technology, 23*, 601-610.

Wolf, T., Debut, L., Sanh, V., Chaumond, J., Delangue, C., Moi, A., … & Rush, A. M. (2020). HuggingFace's transformers: State-of-the-art natural language processing. arXiv:1910.03771.

World Health Organization (2026). Ageing and health. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health.

Wünderlich, N. V., Hogreve, J., Chowdhury, I. N., Fleischer, H., Mousavi, S., Rötzmeier-Keuper, J., & Sousa, R. (2020). Overcoming vulnerability: Channel design strategies to alleviate vulnerability perceptions in customer journeys. *Journal of Business Research*, *116*, 377-386.

Yuan, S., Coghlan, S., Lederman, R., & Waycott, J. (2022). Social robots in aged care: Care staff experiences and perspectives on robot benefits and challenges. *Proceedings of ACM Human Computer Interactions, 6*(CSCW2), 329.

Zeng, H., Sheng, Y., & Zhu, J. (2025). Companion robots supporting the emotional needs of the elderly: Research trends and future directions. *Information*, *16*(11), 948.

Zhao, X., Huo, Y., Lee, H., Abedin, M. Z., & Shi, H. (2026). How does customer ESG performance affect supplier carbon disclosure? *Journal of Business Research*, *216*, 116421.

Zhou, Q. (2025). The current status and future development of elderly care robot technology. *Science and Technology of Engineering, Chemistry and Environmental Protection*, *1*(6). https://doi.org/10.61173/fz8apd74.

Appendix A: Details of Language Model Fine-Tuning and Dictionary Development

Table A1: Hyperparameters for Language Model Fine-Tuning

Training Aspect	Details
Model Architecture	RoBERTa (large)
Learning Rate	2e-5
Epochs	3
Max. Sequence Length	128
Training Batch Size	8
Evaluation Batch Size	8

Table A2: Dictionaries for the Four Attributes of Robopets

Attributes	Words
Visual	appear, color, eye, gaze, glimpse, glance, look, lifelike, notice, observe, see, show, spot, stare, view, visual, watch, inspect, perceive, shape, form, outline
Tactile	cold, contact, feel, fur, furry, grasp, handle, hard, hold, press, rough, rub, smooth, soft, tactile, texture, touch, warm, stroke, pat, clutch, grip, chilly, lukewarm, hot, grainy, velvety, slick
Auditory	audio, auditory, bark, hear, listen, meow, mew, mute, noise, purr, ring, shout, sound, volume, whir, whisper, roar, hum, buzz, chirp, loud, quiet, shrill, faint, echo, resonate, vibrate
Movement	drive, blink, fly, jump, motion, move, navigate, run, shift, step, stir, swing, travel, turn, walk, twist, pivot, roll, slide, ride, cruise, skid, dash, fast, slow, steady, erratic

Table A3: Dictionary for Disability

autism, seizure, adhd, alzheimer's, alzheimers, dementia, stroke, parkinson's, ocd, epilepsy, brain injury, migraine, memory loss, confusion, cognitive decline, tremor, spasm, numbness, depression, anxiety, ptsd, schizophrenia, bipolar disorder, panic disorder, phobia, fear, stress, restlessness, mood swings, cope, manage, relax, recover, cancer, arthritis, copd, diabetes, hypertension, fibromyalgia, pain, swelling, fatigue, therapy, medication, rehabilitation, hearing loss, blind, deaf, low vision, deafness, hard of hearing, blurred vision, night blindness, hearing aid, glasses, magnifier

Appendix B: Regression Results

Table B1: Regression Results with Control Function Adjustment

	Model 1 DV: Realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved Well-being		Model 5 DV: Improved Well-being	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Visual	21.459***	7.982								
Tactile	27.940**	14.102								
Auditory	18.834	19.511								
Movement	-0.253	13.747								
Realism (Dummy)			0.073***	0.011	0.034	0.023	0.410**	0.208	0.826	0.647
Attachment (Dummy)	0.351***	0.041	0.075***	0.004	0.012	0.017	1.529***	0.109	0.342	0.286
Past Pet Ownership or Love for Animals (Dummy)	0.440***	0.056	0.050***	0.003	-0.041***	0.011	1.877***	0.166	0.922*	0.556
Realism x Gifter					0.033*	0.019			-0.795	0.509
Realism x Carer					-0.003	0.037			-0.406	0.289
Realism x Self					0.121**	0.056			-0.183	0.585
Attachment x Gifter					0.086***	0.017			2.057***	0.406
Attachment x Carer					0.050***	0.015			0.681	0.726
Attachment x Self					0.205***	0.021			0.720*	0.429
Past Pet Ownership / Love for Animals x Gifter					0.050**	0.023			1.520***	0.283
Past Pet Ownership / Love for Animals x Carer					0.029	0.018			0.187	0.207

	Model 1 DV: Realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved Well-being		Model 5 DV: Improved Well-being	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Past Pet Ownership / Love for Animals x Self					0.169***	0.022			1.898***	0.161
Reviewer Type: Gifter	0.409***	0.122	-0.034**	0.014	-0.082***	0.020	-0.844**	0.395	-1.04**	0.410
Reviewer Type: Carer	0.485***	0.151	-0.065***	0.011	-0.072***	0.011	0.085	0.215	0.177	0.127
Reviewer Type: Self	0.459***	0.061	-0.149***	0.008	-0.277***	0.018	-1.578***	0.192	-1.789***	0.140
Word Count	0.005***	0.000	-0.001***	0.000	-0.001***	0.000	-0.002	0.002	-0.002	0.002
Concreteness	-0.304***	0.037	-0.031***	0.010	-0.040***	0.011	0.126	0.098	0.089	0.091
Emotionality	1.284***	0.076	0.506***	0.012	0.485***	0.015	2.181***	0.145	2.19***	0.147
Country: Canada	-0.769***	0.205	-0.024	0.020	-0.021	0.020	-0.341	0.248	-0.394	0.281
Country: United Kingdom	-0.272	0.181	-0.040	0.045	-0.037	0.041	-0.316**	0.145	-0.391**	0.180
Country: United States	-0.704***	0.069	-0.148***	0.044	-0.149***	0.050	-0.793*	0.423	-0.862*	0.447
Verified Buyer (Dummy)	0.109*	0.062	-0.057	0.036	-0.062*	0.036	-0.418***	0.124	-0.429***	0.128
Position among Reviews	0.000	0.000	0.000***	0.000	0.000***	0.000	0.000	0.000	0.000	0.000
No. of Images	0.025	0.059	0.017***	0.005	0.016***	0.005	-0.088*	0.051	-0.091*	0.053
Beneficiary disability (Dummy)	0.095	0.078	0.029***	0.008	0.026***	0.008	0.592***	0.163	0.561***	0.162
Year – 2016	0.142***	0.055	0.005	0.028	0.033	0.031	0.409	0.795	0.693	0.664
Year – 2017	0.564***	0.098	0.018	0.025	0.052**	0.025	0.884	0.597	1.205***	0.464
Year – 2018	0.432***	0.067	0.005	0.023	0.031	0.024	0.339	0.687	0.629	0.560
Year – 2019	0.231	0.156	-0.007	0.024	0.020	0.022	0.189	0.695	0.487	0.540
Year – 2020	0.074	0.045	-0.046	0.045	-0.016	0.041	-0.012	0.898	0.293	0.755

	Model 1 DV: Realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved Well-being		Model 5 DV: Improved Well-being	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Year – 2021	0.087	0.065	-0.083	0.057	-0.053	0.056	-0.045	0.924	0.242	0.805
Year – 2022	0.067	0.158	-0.107	0.072	-0.076	0.072	-0.185	1.088	0.123	0.950
Year – 2023	-0.239	0.271	-0.058	0.103	-0.018	0.099	0.498	1.312	0.845	1.153
Year – 2024	0.553	0.457	-0.193	0.121	-0.161	0.116	0.542	1.257	0.874	1.085
Year – 2025	0.816**	0.352	-0.228**	0.097	-0.201**	0.093	0.475	1.260	0.810	1.096
Year – 2026	-0.601	0.565	0.011	0.104	0.038	0.109	0.923	1.029	1.239	0.924
Residual (Visual)	-1.04E+13	-2.80E+13								
Residual (Tactile)	1.82E+13*	-9.60E+12								
Residual (Auditory)	-1.24E+13	-2.25E+13								
Residual (Movement)	-6.46E+11	-3.12E+13								
Residual (Realism)			2.085*	1.145	2.375**	1.062	4.580	3.758	5.820	4.182
Residual (Attachment)			0.520	1.032	0.808	1.103	12.507**	4.906	14.632***	5.098
Residual (Past Pet Ownership / Love of Animals)			1.017*	0.577	0.491	0.502	1.021	5.678	-2.044	6.902
Observations	3,693		3,693		3,693		3,693		3,693	

*** $p < .01$, ** $p < .05$, *$p < .10$. Notes: Significance is based on two-tailed tests. Models 1, 4, and 5 use binary logistic regression, while Models 2 and 3 use linear regression. The reference categories for reviewer type, country, and year are allied health professionals, Australia, and 2015, respectively. We use robust standard errors in our estimation to account for observations clustered along product lines.

Table B2: Regression Results with Heteroscedasticity-Consistent Robust Standard Errors

	Model 1 DV: Realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved Well-being		Model 5 DV: Improved Well-being	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Visual	21.459	3451.124								
Tactile	27.940	12191.927								
Auditory	18.834	14763.263								
Movement	-0.253	7903.696								
Realism (Dummy)			0.073***	0.013	0.034	0.044	0.41***	0.155	0.826	0.815
Attachment (Dummy)	0.351	2568.065	0.075***	0.013	0.012	0.044	1.529***	0.220	0.342	0.945
Past Pet Ownership or Love for Animals (Dummy)	0.440	3872.275	0.050***	0.012	-0.041	0.033	1.877***	0.143	0.922	0.569
Realism x Gifter					0.033	0.044			-0.795	0.830
Realism x Carer					-0.003	0.043			-0.406	0.849
Realism x Self					0.121**	0.048			-0.183	0.830
Attachment x Gifter					0.086**	0.037			2.057***	0.686
Attachment x Carer					0.050	0.034			0.681	0.603
Attachment x Self					0.205***	0.038			0.720	0.601
Past Pet Ownership / Love for Animals x Gifter					0.050	0.047			1.520	1.005
Past Pet Ownership / Love for Animals x Carer					0.029	0.044			0.187	0.981
Past Pet Ownership / Love for Animals x Self					0.169***	0.050			1.898*	0.996

	Model 1 DV: Realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved Well-being		Model 5 DV: Improved Well-being	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
Reviewer Type: Gifter	0.005	-3.391	-0.001***	0.000	-0.001***	0.000	-0.002	0.001	-0.002	0.001
Reviewer Type: Carer	-0.304	147.349	-0.031**	0.015	-0.04***	0.015	0.126	0.144	0.089	0.147
Reviewer Type: Self	1.284	326.699	0.506***	0.021	0.485***	0.022	2.181***	0.144	2.19***	0.142
Word Count	-0.769	3559.442	-0.024	0.037	-0.021	0.037	-0.341	0.512	-0.394	0.521
Concreteness	-0.272	5664.300	-0.040	0.039	-0.037	0.039	-0.316	0.528	-0.391	0.536
Emotionality	-0.704	3125.557	-0.148***	0.037	-0.149***	0.037	-0.793	0.519	-0.862	0.526
Country: Canada	0.109	353.514	-0.057**	0.025	-0.062**	0.025	-0.418**	0.211	-0.429**	0.213
Country: United Kingdom	0.000	2.664	0***	0.000	0***	0.000	0*	0.000	0**	0.000
Country: United States	0.025	1114.429	0.017***	0.006	0.016***	0.006	-0.088	0.065	-0.091	0.066
Verified Buyer (Dummy)	0.095	4418.805	0.029***	0.011	0.026**	0.011	0.592***	0.130	0.561***	0.130
Position among Reviews	0.409	7951.888	-0.034	0.021	-0.082**	0.033	-0.844***	0.300	-1.04***	0.337
No. of Images	0.485	1081.676	-0.065***	0.019	-0.072**	0.031	0.085	0.301	0.177	0.339
Beneficiary disability (Dummy)	0.459	3881.281	-0.149***	0.024	-0.277***	0.036	-1.578***	0.301	-1.789***	0.342
Year – 2016	0.142	2317.595	0.005	0.125	0.033	0.131	0.409	1.361	0.693	1.326
Year – 2017	0.564	1567.062	0.018	0.124	0.052	0.130	0.884	1.361	1.205	1.325
Year – 2018	0.432	16652.226	0.005	0.125	0.031	0.131	0.339	1.347	0.629	1.313
Year – 2019	0.231	647.356	-0.007	0.124	0.020	0.130	0.189	1.350	0.487	1.314
Year – 2020	0.074	791.787	-0.046	0.123	-0.016	0.129	-0.012	1.341	0.293	1.305
Year – 2021	0.087	309.814	-0.083	0.125	-0.053	0.131	-0.045	1.347	0.242	1.311

Variable	Model 1 DV: Realism		Model 2 DV: Ratings		Model 3 DV: Ratings		Model 4 DV: Improved Well-being		Model 5 DV: Improved Well-being	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Year – 2022	0.067	326.066	-0.107	0.125	-0.076	0.131	-0.185	1.352	0.123	1.316
Year – 2023	-0.239	5979.883	-0.058	0.152	-0.018	0.158	0.498	1.436	0.845	1.411
Year – 2024	0.553	6530.748	-0.193	0.133	-0.161	0.139	0.542	1.369	0.874	1.335
Year – 2025	0.816	6539.005	-0.228*	0.129	-0.201	0.134	0.475	1.358	0.810	1.322
Year – 2026	-0.601	5995.837	0.011	0.162	0.038	0.168	0.923	1.434	1.239	1.406
Residual (Visual)	-1.04E+13	9.41E+15								
Residual (Tactile)	1.82E+13	7.94E+15								
Residual (Auditory)	-1.24E+13	1.76E+16								
Residual (Movement)	-6.46E+11	1.94E+16								
Residual (Realism)			2.085	2.158	2.375	2.295	4.580	14.859	5.820	15.808
Residual (Attachment)			0.520	1.517	0.808	1.545	12.507	9.371	14.632	10.319
Residual (Past Ownership / Love of Animals)			1.017	1.880	0.491	2.028	1.021	16.029	-2.044	17.082
Observations	3,693		3,693		3,693		3,693		3,693	

*** $p < .01$, ** $p < .05$, *$p < .10$. Notes: Significance is based on two-tailed tests. Models 1, 4, and 5 use binary logistic regression, while Models 2 and 3 use linear regression. The reference categories for reviewer type, country, and year are health professionals, Australia, and 2015, respectively. We use robust standard errors in our estimation to account for observations clustered along product lines.

Table B3: Regression Results for Control Function Adjustment (Realism, Attachment, and Past Ownership / Love of Animals)

	Model 1 DV: Realism		Model 2 DV: Attachment		Model 3 DV: Past Ownership / Love for Animals	
Variable	**Est.**	**SE**	**Est.**	**SE**	**Est.**	**SE**
LOO: Realism	-50457.920***	6253.380				
LOO: Attachment			-50754.165***	6469.065		
LOO: Past Ownership / Love of Animals					-50322.403***	6186.255
Reviewer Type: Gifter	-1.363***	0.097	-1.508***	0.112	-1.330***	v
Reviewer Type: Carer	-1.537***	0.084	-1.351***	0.189	-1.439***	0.088
Reviewer Type: Beneficiary	-1.890***	0.092	-1.868***	0.135	-1.668***	0.067
Word Count	-0.007***	0.001	0.007***	0.001	-0.007***	0.001
Concreteness	-0.687***	0.165	-1.234***	0.103	-0.775***	0.171
Emotionality	-0.938***	0.033	-0.641***	0.045	-0.865***	0.032
Country: Canada	-1.824***	0.308	-1.768***	0.487	-1.693***	0.335
Country: United Kingdom	-2.290**	1.063	-1.975	1.244	-2.234**	1.069
Country: United States	-3.057***	0.315	-2.842***	0.402	-3.021***	0.345
Verified Buyer (Dummy)	-1.042***	0.274	-1.357***	0.180	-0.938***	0.323
Position among Reviews	0.000	0.000	0.000	0.000	0.000	0.000
No. of Images	0.431***	0.055	-0.641***	0.058	0.475***	0.059
Disabled Beneficiary (Dummy)	0.019	0.075	-0.061	0.041	-0.044	0.080
Year - 2016	-2.976***	0.222	5.075***	0.804	-3.004***	0.260
Year - 2017	-3.169***	0.395	4.858***	0.678	-3.385***	0.410

Variable	Model 1 DV: Realism		Model 2 DV: Attachment		Model 3 DV: Past Ownership / Love for Animals	
	Est.	SE	Est.	SE	Est.	SE
Year - 2018	-3.356***	0.459	4.480***	0.636	-3.589***	0.525
Year - 2019	-3.794***	0.397	4.564***	0.653	-3.906***	0.488
Year - 2020	-3.880***	0.442	3.991***	0.521	-4.054***	0.521
Year - 2021	-3.912***	0.334	4.387***	0.639	-4.070***	0.407
Year - 2022	-3.725***	0.259	4.543***	0.743	-4.024***	0.335
Year - 2023	-1.267	0.868	6.338***	1.147	-1.401	0.889
Year - 2024	-2.158***	0.575	5.173***	1.292	-2.455***	0.523
Year - 2025	-2.384***	0.420	4.958***	1.209	-2.718***	0.397
Year - 2026	-0.508	0.556	6.760***	1.266	-0.574	0.587

Notes: *** $p < .01$, ** $p < .05$, *$p < .10$. Significance is based on two-tailed tests. Models use binary logistic regression. The reference categories for reviewer type, country, and year are health professionals, Australia, and 2015, respectively. We use robust standard errors in our estimation to account for observations clustered along product lines.