

ORIGINAL ARTICLE

Enhancing corporate brands through service robots: The impact of anthropomorphic design metaphors on corporate brand perceptions

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Abstract

The increasing introduction of intelligent, interactive robots in the service industry raises concerns about the potential dehumanization of service provision and its influences on corporate brand perceptions. To avoid adverse effects, new service development (NSD) managers seemingly favor service robots that feature anthropomorphic design metaphors, so they appear more human-like. The current research investigates explicitly how customers' perception of a robot's anthropomorphic design metaphors might spill over to affect corporate brand perceptions. Study 1, a picture-based scenario study with 109 participants, reveals the impact of anthropomorphic design metaphors on untested corporate brand outcomes, such as brand trust and brand experience. Then Study 2, a video-based scenario study with 530 participants, addresses whether these effects depend on the service context. In Study 3, a field study of 393 participants, the authors examine how anthropomorphic design metaphors influence other firm-related outcomes (e.g., shopping enjoyment, sales). The combined results confirm that anthropomorphic design metaphors strongly affect brand trust and brand experience, as well as other critical firm-related outcomes; they also reveal notable context effects, such that customers of people-processing (e.g., care services) and mental-stimulus-processing (e.g., shopping assistance) services appear more likely to use anthropomorphic design metaphors as corporate brand cues. Our research encourages NSD managers and scholars to consider the effects of introducing anthropomorphic service robots on corporate brands.

KEYWORDS

anthropomorphism, corporate brand, design metaphors, new service development, service robots

1 | INTRODUCTION

Significant changes in service provision are emerging with the advent of intelligent, interactive robots that can

operate mostly autonomously (Roggeveen et al., 2020) and provide various services, including delivery, shopping assistance, and health care provision (Jörlling et al., 2019). Such service tasks involve direct contact

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between robots and customers, with implications for customers' evaluation of not just the robot but also the firm and its corporate brand. Concurrently, advancements in robotics, exemplified by the innovations of Boston Dynamics, are often characterized as simultaneously disconcerting and impressive (Moses & Ford, 2021). Considering that many customers harbor reservations about such robots and worry about dehumanized service provision (Wirtz et al., 2018), it is unclear whether corporate brands benefit from the introduction of innovative new services delivered by robots (Mashable, 2023). A corporate's brand is an important construct that contributes to establishing firm value, an objective also targeted by innovation management. Because the corporate brand is essential for differentiating specific offerings from those of competitors and for establishing persistent, positive associations (Luchs & Swan, 2011), managers involved in new service development (NSD) must consider the potential impacts of incorporating robotic technology into their offerings on the corporate brand.

Many NSD managers already do so, according to the widespread efforts in practice to employ robots that appeal to customers. Robot designers frequently modify the physical attributes of robots and commonly integrate features that evoke a sense of warmth and humanity, thus making the robots more palatable to the customers. For example, SoftBank's 4-foot-tall Pepper robot features a humanlike design and can adopt poses that mirror human body language, prompting more than 2000 companies worldwide to incorporate Pepper into various customer service roles (SoftBank Robotics, 2021). Product designers also take inspiration from nature and adopt design metaphors that subtly or overtly emulate natural creatures or objects (Noble & Kumar, 2008), including birds, insects, or humans (Noble et al., 2013). Instances of this innovative design approach include anthropomorphic design elements in cars and mobile phones that grant them "facial" expressions (Landwehr et al., 2011). In robotics contexts, visual design metaphors hinting at human resemblance (Blut et al., 2021) rely on the robot's humanoid body shapes, facial features, and movements. The impact of anthropomorphic design metaphors on human perceptions can be explained through the mechanism of anthropomorphism, which is the human tendency to see human-like shapes in the environment (Epley et al., 2007).

Most studies of robot anthropomorphism consider the effects on customers' future usage intentions (Blut et al., 2021). In a few studies of its impact on brand perceptions, we find relatively ambiguous insights regarding the influence of anthropomorphic design metaphors. For example, Noble et al. (2013) indicate that animal-based and humanlike design metaphors applied to a robot's fictional product brand effectively enhance brand vividness,

Practitioner points

- New service development (NSD) managers are advised to select robots featuring anthropomorphic design metaphors to improve customers' service assessments and create enduring positive effects on the corporate brand. Such an approach is likely to enhance customers' trust in the corporate brand as well as the overall brand experience.
- It is crucial for NSD managers to consider the service context when employing service robots with anthropomorphic designs. The effectiveness of anthropomorphic design metaphors in improving corporate brand outcomes is notably amplified in service contexts where customers are direct recipients of the service, whether mentally or physically. Thus, NSD managers should encourage customers to engage directly with robots to enhance their appreciation of the interaction.
- Beyond enhancing customers' in-store shopping experiences, the use of service robots with anthropomorphic designs could lead to broader benefits, such as increased frequency of store visits and extended duration of those visits. This aspect should be a key consideration in NSD managers' strategic decisions.

compared with no metaphor, but Raff et al. (2020) question whether smart products like service robots should be anthropomorphized, because doing so leads customers to develop exaggerated expectations of the products' advanced capabilities (e.g., total autonomy, ability to cooperate). McLeay et al. (2021) also suggest that if humanoid robots take over employees' customer service roles, it could be perceived negatively by consumers and indirectly reduce their brand usage intentions. Choi et al. (2022) find that customers react negatively to high-contact robots if the brand has a sincere personality.

These studies generally do not extend beyond product-level brand outcomes (McLeay et al., 2021; Noble et al., 2013) to consider the corporate brand, which represents the overall organization and organizational associations, such as credibility (Aaker, 2004). Arguably though, the associations evoked by service robots should extend beyond the endorsed product, to the firm. Finally, because most studies focus on the impact of anthropomorphic service robots in isolated service settings, the relevance of contextual factors that might moderate the effects of anthropomorphic design metaphors on brand outcomes remains unclear. Noting evidence of variability

in the effects of anthropomorphism on different outcomes across service types and industries (Blut et al., 2021; McLeay et al., 2021), we anticipate that such variation might also apply to brand outcomes.

To address these gaps in extant research, we pursue answers to several pivotal research questions: Do anthropomorphic robots affect a firm's reputation, and particularly, customers' perceptions of the corporate brand? Which specific brand outcomes are affected by anthropomorphic design metaphors? Should NSD managers rely on robots with anthropomorphic design metaphors to improve corporate brand perception, and if so, in which service contexts? By exploring these questions across three empirical studies, in which we examine the impact of robots' anthropomorphic design metaphors on corporate brand perceptions and other firm-related outcomes, we make several pertinent contributions. We extend the scope of design metaphor theory, beyond customer responses to product-centered design metaphors (Noble et al., 2013), to establish that customers often rely on anthropomorphic design metaphors in their corporate brand evaluations. As our results indicate, anthropomorphic design metaphors affect both brand trust and brand experience, as well as other firm-related outcomes critical to NSD managers, such as positive word of mouth (WOM), patronage behavior, and shopping assessments. Therefore, NSD managers can select robots with anthropomorphic design metaphors and promote direct customer interactions. Furthermore, we provide in-depth insights into contextual factors that can augment or attenuate the influence of anthropomorphic design metaphors in service robots. On the basis of a foundational typology of service contexts provided by Wirtz et al. (2013), we identify contexts in which anthropomorphic design metaphors are most likely to produce the desired outcomes for corporate brands. Specifically, customers of people-processing services, such as health care, and mental-stimulus-processing services, such as shopping assistance, more readily use anthropomorphic design metaphors as a corporate brand cue. Therefore, managers can improve corporate brand perceptions by introducing service robots with anthropomorphic metaphors in such settings.

2 | ANTHROPOMORPHIC DESIGN METAPHORS

2.1 | Design metaphors

According to Bloch (2011), product design is a three-dimensional concept, encompassing esthetic, functional, and symbolic aspects. The esthetic dimension pertains to

a product's perceived visual appeal and attractiveness; the functional dimension relates to its capacity to fulfill its intended purpose; and the symbolic dimension involves the message conveyed to customers through its visual elements (Bloch, 2011).¹ To embed one or more of these dimensions in a product, designers might deploy design metaphors (Tung & Tseng, 2019), defined as "any kind of product whose design intentionally references the physical properties (e.g., form, sound, movement, smell, and so on) of another entity for specific, expressive purposes" (Hekkert & Cila, 2015, p. 199). Such metaphors help translate concepts, often found in nature (e.g., animals, birds, insects), into the properties of a product (Noble et al., 2013). Because metaphorical thinking is fundamental to human reasoning, metaphors help communicate values and meanings to customers, including those that designers seek to assign to a product (van Rompay, 2008).

In product settings, metaphors also serve as a type of design innovation (Noble et al., 2013), guiding designers' choices of product appearance features, shapes, proportions, colors, and textures (Kellaris & Kent, 1993), which also must be aligned. Gestalt psychologists argue that customers perceive a product as a whole (e.g., the form of a car) before processing individual product features (e.g., tires, fenders, windshields) (Bloch, 1995). Design metaphor theory further acknowledges that metaphors can elicit various consumer responses, reflecting their specific instrumental and functional goals (Hekkert & Cila, 2015). For example, design metaphors can reduce the cognitive effort needed to understand a product's instrumental meaning and function, as well as give customers rich sensorial, emotional, or meaningful product experiences (Hekkert & Cila, 2015), so that designers can tell a story through the product. Finally, metaphors often provoke consumer actions, such as product interactions or purchases (Crilly et al., 2009).

However, design metaphors are not always or universally effective. Just as product designers follow a metaphorical process when developing a product, customers follow a metaphorical process to interpret it (Hekkert & Cila, 2015). Because they lack insights into the designers' thought processes, they analyze the product by comparing its features with their own unique standards, expectations, and experiences (Crilly et al., 2009). Ambiguous design metaphors even may lead to misinterpretations, which is why prior research calls for designers to assess carefully whether customers understand the intended

¹Luchs and Swan (2011) emphasize the need to distinguish product form versus product function in scholarly discourse; accordingly, Creusen and Schoormans (2005) propose using the term "product appearance" instead of "product form."

meaning (van Rompay, 2008). Even if they recognize and interpret the product metaphor correctly, though, customers might not appreciate it (Hekkert & Cila, 2015). Consumer reactions never occur in isolation, and preferences for metaphors reflect cultural and social influences (Bloch, 1995), consumer characteristics (e.g., individual preferences), and situational factors. Therefore, designers must consider whether and when customers might appreciate design metaphors. To inform such considerations, we focus explicitly on the effectiveness of one specific design metaphor, namely, one that mimics humans.

2.2 | Customer responses to anthropomorphic design metaphors

Designers have long used anthropomorphic design metaphors to assign human qualities to various products (Landwehr et al., 2011)—athletic shoes, smoothie makers, sunglasses, cell phones, and so on—and through different product features. As Velasco et al. (2021) explain, designers might change a product's features (e.g., smiling, upturned grille on car, arms of a corkscrew), add facial features to product logos (e.g., Amazon logo), stress verbal cues in product names (e.g., Amazon's Alexa, IBM's Watson), or suggest that products have mental or human capabilities (e.g., Mr. Clean). By mimicking human qualities, these products tap into customers' tendency to attribute humanlike qualities and characteristics to everyday products (Mondloch et al., 1999), which Guthrie (1997) explains by noting the importance of familiarity. That is, consumers build mental maps of the world and use familiar objects, such as human characteristics, as reference points (Noble et al., 2013).

Even if customers tend to prefer such humanlike objects (Mondloch et al., 1999), empirical findings related to anthropomorphic designs are mixed. In their meta-analysis, Velasco et al. (2021) compare the effects of anthropomorphic versus non-anthropomorphic designs on customers' product evaluations and find a small but significant influence. However, about 35% of the studies they analyze indicate that non-anthropomorphic designs perform better than anthropomorphic designs, suggesting that the design might be effective in some situations but not others. Furthermore, the studies included in the meta-analysis tend to investigate everyday products rather than technology-focused contexts, and the authors do not address the different performance measures that might be used to assess product success.

Notably, Raff et al. (2020) question whether service robots should be anthropomorphized, considering that customers might develop exaggerated expectations of

these smart products due to their advanced capabilities. Another meta-analysis, conducted by Blut et al. (2021), offers some insights by synthesizing the results of 152 service robot studies. Some of those studies manipulate single robot features (e.g., embodiment, emotion, gaze, gesture, mimicry, voice) to induce anthropomorphism; others contrast humanlike with nonhuman-like robots that differ in multiple features. The results indicate that anthropomorphic designs elicit some positive product evaluations, such as satisfaction and positive affect, influencing customers' intentions to use the products. However, the effect sizes also vary significantly, suggesting that customers do not always appreciate anthropomorphic robot designs. Therefore, Blut et al. (2021) call for scholars to explore other outcomes of anthropomorphism, beyond usage intention, including willingness to pay for a service, purchase behaviors, and corporate brand perceptions.

As literature on service robots has progressed, scholars also have started examining more diverse outcomes of anthropomorphic robot designs that reflect their enhanced ability to mimic humans, such as engaging in empathetic feeling tasks (Esmaeilzadeh & Vaezi, 2022; Pantano & Scarpi, 2022; Pitardi et al., 2023). Recent studies move beyond classical outcomes identified in technology acceptance literature (e.g., usefulness and ease of use; Sheehan et al., 2020) to address positive emotions, social presence, and trust (Filieri et al., 2022; Hildebrand & Bergner, 2021), as well as willingness to pay and expected service quality (Yoganathan et al., 2021). Building on such advances, we seek to investigate a more comprehensive set of outcomes, including corporate brand- and firm-related outcomes, along with multiple contextual moderators.

3 | CONCEPTUAL BACKGROUND

3.1 | Conceptual model

The conceptual model is in Figure 1. In line with design metaphor theory, we propose that anthropomorphic design metaphors in service robots affect both corporate brand perceptions (e.g., brand trust, brand experience) and firm-related outcomes (e.g., spending behavior). To assess firm-related outcomes, we examined the effects of the anthropomorphic robot Pepper in an apparel store on various store-related performance outcomes. We anticipate that the impact depends on the context, so we also assess the moderating influence of the service context.

In more detail, rather than the effects of anthropomorphic design metaphors on consumer beliefs, such as durability, ease of use, or prestige (Bloch, 1995; Luchs &

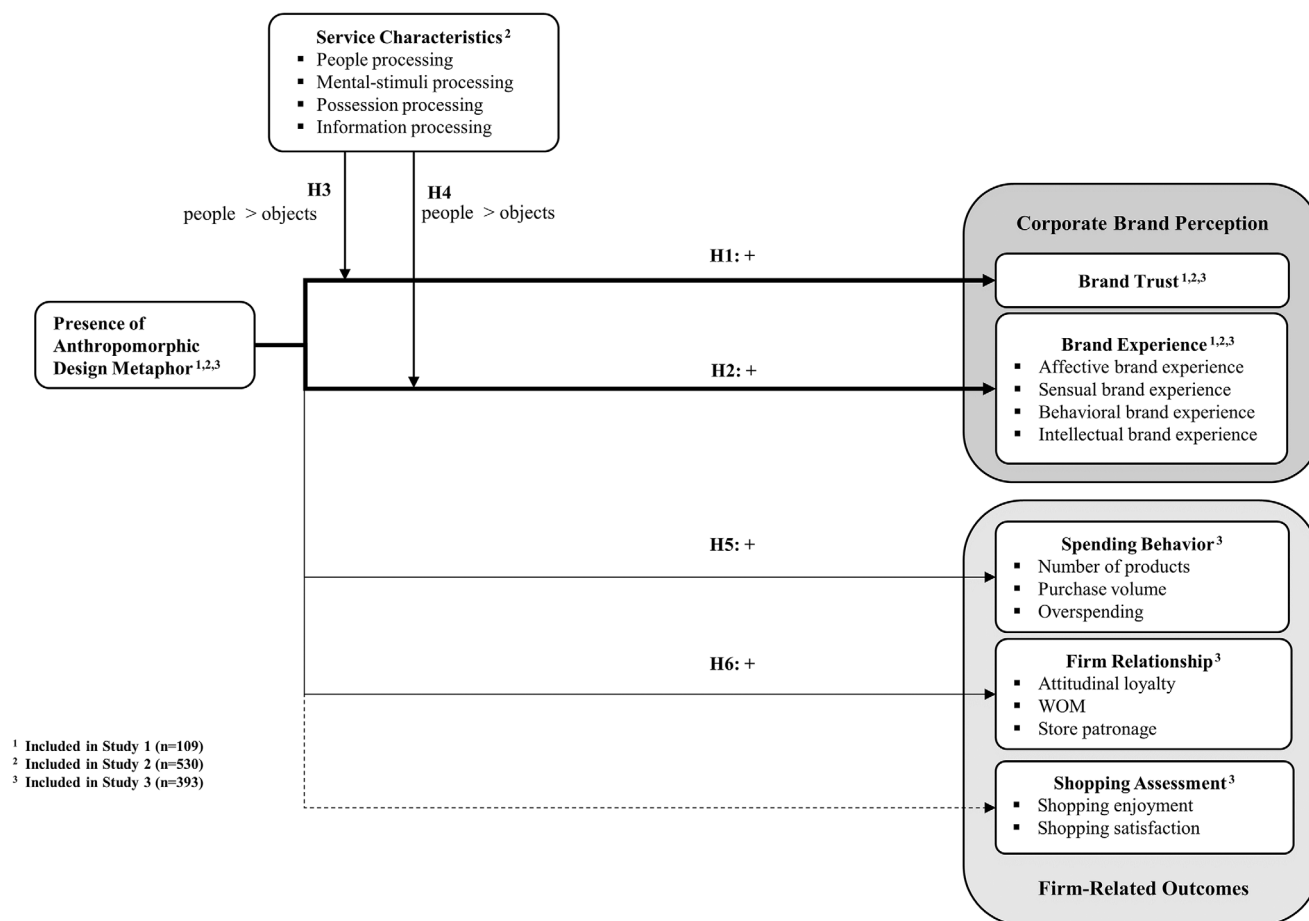


FIGURE 1 Conceptual model. The effects of anthropomorphism on shopping satisfaction and enjoyment are well-documented (Blut et al., 2021), so we do not formulate hypotheses for these outcomes. We do not test the moderating effect of service characteristics on firm-related outcomes, which we measure only in Study 3, a field study conducted within a retail context.

Swan, 2011), we prioritize firm performance measures for this study, in the form of corporate brand perceptions and firm-related outcomes. As noted previously, brand perception is essential to a firm's innovation activities (Noble et al., 2013). Still, product and corporate brands differ, depending on the object of branding activities (Rao et al., 2004).² The corporate brand defines the organization that delivers and stands behind the service offering, primarily represented by organizational associations, such as credibility (Aaker, 2004). It also strongly determines firm value, which is the primary goal of innovation activities (Luchs & Swan, 2011; Rao et al., 2004), so firms invest considerable resources into strategic brand concept

management efforts, which arguably should enable them to achieve customer price premiums, market shares, and profitability (Aaker, 1996; Park et al., 1986). Drawing from Chaudhuri and Holbrook's (2001) framework, we also recognize that brand loyalty is influenced by brand trust and the affect it incites. However, customers' brand experiences might span multiple dimensions, including affective, sensual, behavioral, and intellectual ones (Brakus et al., 2009). Therefore, we incorporate these various dimensions into our exploration of the influences of anthropomorphic robot designs on corporate brand perceptions. With regard to firm-related outcomes, we assess the influences on customer spending behavior and firm relationship measures (e.g., customer loyalty, WOM, and patronage), as are widely used to evaluate service firms' performance (Grewal et al., 2009). The effects of design metaphors on such outcomes have yet to be fully determined (Yoganathan et al., 2021); understanding the impact of anthropomorphic robot designs on them could greatly enhance design metaphor theory.

²Innovation literature highlights the need to differentiate outcomes to advance theory (Luchs & Swan, 2011). In branding literature, Keller and Richey (2006) note that companies succeed due to not just their products or services but also their corporate identity. Marketing and management literature also predicts spill-over effects between product and corporate brands, though these effects appear context- and customer-dependent (Baumeister et al., 2015).

3.2 | Impact of anthropomorphic design metaphors on corporate brand perceptions

Anthropomorphic design metaphors in robots include human appearance features like eyes, hands, body forms, and faces (Phillips et al., 2018). As Eisenman (2013, p. 332) notes, visible design attributes “allow producers to explain what their products do and how best to use them, to excite users in a way that generates sales, and to extend the basic functionalities of their products by highlighting their symbolic meaning.” In addition to imitating human traits and behaviors (Bartneck et al., 2009), anthropomorphic design metaphors in service robots show customers how to interact with them like human service representatives. As robot design studies generally affirm, a more humanlike appearance fosters positive customer attitudes (Chartrand et al., 2008), though with exceptions, as indicated by the uncanny valley effect, or the eerie feeling of unfamiliarity when robots seem too close to humans (Mori et al., 2012). This uncanny valley effect can arise, even if rarely, in relation to service robots intentionally designed to interact with humans (Mathur et al., 2020), leading customers to reject the robots. Such outcomes are not effective for creating positive corporate brand associations. Psychological factors also can undermine evaluations of anthropomorphic robots, such as if customers feel discomfort interacting with a humanoid, versus a machine-like, robot due to fears about feeling judged by the robot (Holthöwer & van Doorn, 2023).

We contend though that anthropomorphic design metaphors enhance brand perceptions overall, by increasing perceived social presence. If a robot features an anthropomorphic design, customers perceive more social presence, “a psychological state in which virtual social actors are experienced as actual social actors in either sensory or non-sensory ways” (Lee, 2004, p. 45). According to van Doorn et al. (2017), social presence in human–robot interaction (HRI) settings implies that customers feel as if they are in the company of another social entity (Waytz et al., 2014). When evoked by anthropomorphic designs, such social presence might enhance brand trust, defined as “the willingness of the average consumer to rely on the ability of the brand to perform its stated function” (Chaudhuri & Holbrook, 2001, p. 82). As Homburg et al. (2015, p. 50) note, any “product design can serve as a signal and, as such, help customers to overcome uncertainty such as doubt about the quality of a product.” Brand trust is especially vital in unfamiliar scenarios, such as novel business encounters with robots (Matzler et al., 2008). Noting evidence of a correlation among perceptions of personal, sociable, and sensitive robot interactions with customer trust (van Pinxteren et al., 2019), we propose that anthropomorphic design metaphors affect perceptions of the brand that leverages

the robot, such that customers integrate their perception of trust in the robot, sparked by anthropomorphism, into their overall brand judgment. Formally,

Hypothesis 1. The perceived presence of anthropomorphic design metaphors in service robots positively affects brand trust.

We also anticipate a positive correlation between robot anthropomorphism and the brand experience. Interactions with robots tend to lead to memorable experiences that shape the intensity and valence of customers' brand experiences. Brand experience, as defined by Brakus et al. (2009), is the customer's reaction to any brand-associated product, service, or entity, across cognitive, affective, intellectual, and behavioral dimensions (Hultén, 2011). *Affective experiences* refer to emotions and positive feelings induced by the brand; *sensory experiences* entail its appeal to customers' visual and other senses; *intellectual experiences* arise if the brand can stimulate customers' curiosity and thinking; and *behavioral experiences* encourage customers to engage in physical actions and bodily experiences. Such broad brand experiences, usually evoked by company-related stimuli, can be influenced by advanced technologies (Chan & Tung, 2019; Pantano & Naccarato, 2010).

Although some customers with negative attitudes toward robots likely resist even highly anthropomorphic robots (Syrdal et al., 2009), we predict a positive impact overall, because a robot's anthropomorphic design provides diverse, rich cues that should prompt positive evaluations (Brady et al., 2005). A cue is a “characteristic, event, quality, or object that is external to the customer that is encoded and used to categorize a stimulus object” (Crane & Clarke, 1988, p. 56). Customers build brand perceptions, such as brand affect or experience, depending on cues they can assess (Morhart et al., 2015). We contend that increasing a robot's anthropomorphism enhances all brand experience dimensions in our conceptual framework. For example, with more multimodal cues used to mimic human appearance and behavior, a service robot can look like a specific person with a unique appearance (e.g., particular gender, ethnicity, level of attractiveness) (Hegel et al., 2011) and sound human-like in its voice. This trait elicits increased responses from humans (Sims et al., 2009). The more human-looking and sounding the robots are, the more they appeal to customers' visual and other senses, stimulating a stronger *sensual brand experience*.

While robots' empathetic capabilities are still in nascent stages (Park & Whang, 2022), existing literature predicts robots will soon be able to imitate human empathy (Pepito et al., 2020). However, they currently seem unable to convey affective and genuine empathy

convincingly (Kipnis et al., 2022), potentially complicating the creation of an affective experience. Yet, the degree to which a robot is designed in a humanlike way might influence the affective responses it elicits from customers. A robot's face can convey cues by mimicking both physical and expressive human features, such as age, sex, ethnicity, and emotions (Hegel et al., 2011). Humans respond more emotionally to robots with a humanlike appearance, which can foster an emotional connection (Riek et al., 2009), particularly if the symbolic dimension of anthropomorphic design metaphors enables customers to preserve their self-concept (Belk, 1988). That is, customers might favor human interaction but still find anthropomorphic robots helpful, due to their ability to simulate personal human interactions (Homburg et al., 2015). Therefore, we predict that more human-like robots enhance *affective brand experiences*.

To predict the influence of anthropomorphic design metaphors on *behavioral brand experiences*, we turn to Mehrabian and Russell's (1974) taxonomy of the consumer states triggered by environmental stimuli and the information rate of the environment. Due to the appeal of design metaphors, encounters with robots likely elicit excitement. This stimulating effect is intentionally sought after by NSD managers, because it enhances desirability (Eisenman, 2013; Gemser & Leenders, 2001). Exciting environments encourage approach behavior, and we hypothesize that anthropomorphic design metaphors thus enhance the behavioral brand experience.

Finally, our rationale for how anthropomorphic design metaphors influence *intellectual brand experience* is grounded in the categorical perception hypothesis (Cheetham et al., 2013), which proposes that human cognition sorts perceptions into categories to facilitate efficient information processing. Confronted with a robot exhibiting human and nonhuman characteristics, this categorization task becomes challenging, and cognitive demands escalate (Weis & Wiese, 2020), enhancing customers' cognitive brand perceptions and involvement. These cognitive processes, triggered by anthropomorphic design metaphors, should enhance the intellectual brand experience. In summary:

Hypothesis 2. The perceived presence of anthropomorphic design metaphors in service robots positively affects (a) sensual, (b) affective, (c) behavioral, and (d) intellectual brand experiences.

3.3 | Moderating effects of service contexts

Various service settings feature robots with varying levels of anthropomorphic designs (van Doorn et al., 2017). For

example, shopping assistance robots consult with customers and advise them to purchase specific products (e.g., SoftBank's Pepper); security guard robots patrol malls and parking places (e.g., Knightscope's K5 robot guard). Wirtz et al.'s (2013) service classification can group such service contexts, by differentiating services according to the recipient (people vs. possessions) and the nature of the service act (tangible vs. intangible). This combination produces four service types: people-processing (people, tangible actions), possession-processing (possessions, tangible actions), mental-stimulus-processing (people, intangible actions), and information-processing (possessions, intangible actions) services. We predict that service contexts involving human recipients are more susceptible to the influence of anthropomorphic design metaphors than contexts in which possessions are the objects of the service, for three main reasons.

First, service contexts create uncertainty. In the absence of products, customers form evaluations of situations, objects, and other persons, using various cues that might not be communicated intentionally. In service contexts perceived as risky (e.g., potential harms to the customer), such cues are of even greater importance—as is true of service contexts directly involving customers, such as people-processing and mental-stimulus-processing services. Thus, for example, robotic health care services (people-processing) likely induce greater uncertainty and vulnerability in customers than robot delivery services (possession-processing). In such encounters, marked by heightened uncertainty, customers likely rely more on cues to form evaluations (Paluch & Wunderlich, 2016), including social cues exhibited by anthropomorphic design metaphors in robots, which in turn should influence brand trust and brand experiences more powerfully.

Second, greater involvement in service processes increases the importance of the servicescape, because customers gain opportunities to learn about the provider and its service (Wirtz et al., 2013). If services target possessions, the customer-provider interaction is relatively minimal, making it more difficult for customers to understand the service process and their specific role in the provisioning process (Wirtz et al., 2013). But in service contexts aimed directly at customers themselves, such as people-processing and mental-stimulus-processing services, the consumer engages actively and has ample opportunities to perceive the intricacies of the service context. For example, a student learning from a teaching robot (mental-stimulus-processing) has multiple occasions to perceive its design features. In such contexts, customers likely recognize the anthropomorphic design metaphors in robots and subsequently should be influenced by them.

Third, customers engage in different levels of interaction with the robot, depending on the service context. In

people-processing and mental-stimulus-processing service contexts, in which the service recipient is the customer, customers have direct interactions and experiences rather than indirect ones, as is the case in possession-processing and information-processing contexts. For example, a customer guided to a restaurant table by a robot by physically following its directions (mental-stimulus-processing) is engaged in a direct encounter; a customer whose property is continuously monitored by a security robot (possession-processing) has a more indirect experience. Direct experiences more actively engage customers in learning and provide them with credible and concrete information (Wirtz et al., 2013). Therefore, in service contexts in which customers are the recipients, they are more likely to have direct experiences, which should elicit stronger responses than indirect experiences. Specifically, we contend that customers in people-processing service contexts respond more to anthropomorphic design metaphors in robots than in service contexts where an object is the service recipient.

Hypothesis 3. The effect of the presence of anthropomorphic design metaphors on brand trust is stronger for (a) people-processing services and (b) mental-stimulus-processing services, whereas the effect is weaker for (c) possession-processing services and (d) information-processing services.

Hypothesis 4. The effect of the presence of anthropomorphic design metaphors on brand experience is stronger for (a) people-processing services and (b) mental-stimulus-processing services, whereas the effect is weaker for (c) possession-processing services and (d) information-processing services.

3.4 | Impact of anthropomorphic design metaphors on spending behavior

We anticipate that a robot's anthropomorphic design positively affects customers' spending behavior (i.e., number of products purchased, purchase volume, and overspending). An anthropomorphic appearance comprises many visual and behavioral features, which represent multiple, rich cues that can stimulate the customer and, arguably, lead to more favorable evaluations (Brady et al., 2005). In addition, humanlike robots still represent novel encounters for customers, which tend to encourage information overload and high arousal (Menon & Kahn, 2002). Consumer arousal relates positively to hedonic shopping

value, such that the environment represents a more attractive place to spend time and leads to more impulsive consumer behavior (Babin et al., 1994). A robot with an anthropomorphic design also spurs emotions and empathy (Rosenthal-von der Pütten & Krämer, 2014); the more humanlike a robot, the more it can convey emotions and stimulate experiences (Tung & Au, 2018). Customer emotions and arousal both affect mood and shopping behavior (Babin et al., 1994), including impulsive or compulsive purchase decisions, which implies both more items purchased and greater purchase volumes (Babin & Darden, 1995). In addition to these impacts on affect, a humanlike robot can provide experiential value that delivers a superior customer experience, suggesting larger wallet shares and higher profits (Grewal et al., 2009). Therefore, we predict:

Hypothesis 5. The perceived presence of anthropomorphic design metaphors in service robots positively affects (a) the number of products purchased, (b) the purchase volume, and (c) customers' overspending behavior.

3.5 | Impact of anthropomorphic design metaphors on brand relationships

Finally, a robot's anthropomorphic design might enhance critical branding outcomes that reflect a positive brand relationship: customers' patronage intentions toward the firm (Darden et al., 1983), their attitudinal loyalty toward the brand (Singh & Sirdeshmukh, 2000), and their WOM (Bowman & Narayandas, 2001). Patronage implies a close relationship between the customer, as the patron, and a brand or its store (Darden et al., 1983). This concept also is characterized by reciprocity, in that the brand offers its services, and in return, the patron displays positive attitudes and behaviors toward the brand (Blut et al., 2018). Customer loyalty refers to customers' predisposition to maintain an ongoing relationship with the firm (Singh & Sirdeshmukh, 2000). As Bowman and Narayandas (2001) show, customers who describe themselves as loyal are also significantly more likely to engage in WOM behavior. Such volitional WOM behavior likely follows from consumption satisfaction (Dick & Basu, 1994), though Westbrook (1981) also suggests that customers engage more in WOM when they have notable emotional experiences.

As we noted previously, an anthropomorphic robot appearance can elicit higher social presence (van Doorn et al., 2017) and evoke positive customer evaluations, such as satisfaction, rapport, and positive affect (Qiu et al., 2020). Moreover, an anthropomorphic robot's

appearance increases trust (Li et al., 2010; van Pinxteren et al., 2019). Therefore, if the anthropomorphic robot is presented as part of a brand's store design—a feature that influences patronage intentions (Grewal et al., 2003)—perceptions of the robot might spill over to the brand. In this case, customers integrate the new stimulus information available from their positive evaluation of the anthropomorphic robot's appearance into their overall judgment of the firm and brand that has introduced the robot to them. That is, the perception of the robot spills over to the perception of the brand. Brand image affects customers' brand attachment (Dolbec & Chebat, 2013), so we predict that a robot's humanlike perceptions affect the customer–firm relationship, as measured by store patronage, attitudinal loyalty, and WOM intentions.

Hypothesis 6. The presence of anthropomorphic design metaphors in service robots positively affects (a) attitudinal loyalty, (b) positive WOM, and (c) store patronage.

4 | SUMMARY OF STUDY DESIGNS

In three studies, we test the effects of anthropomorphic design metaphors on brand and firm-related outcomes. With these sequentially ordered studies, our earlier studies inform subsequent ones (Moreau & Engeset, 2016), which strengthens the validity, robustness, and generalizability of our conclusions by demonstrating the consistency of the findings across multiple studies. The later studies also help address the earlier studies' potential limitations.

In detail, with Study 1 ($n = 109$) we investigate the impact of anthropomorphic design metaphors on two key brand outcomes: brand trust (Chaudhuri & Holbrook, 2001) and brand experience (Brakus et al., 2009), which we assess on affective, sensual, intellectual, and behavioral brand experience dimensions. For these initial insights, we use a picture-based scenario study and a robot in a shopping assistance context. Then, in Study 2, we conduct a video-based scenario study ($n = 530$) to determine if the effect of anthropomorphic design metaphors on brand outcomes holds for other services beyond shopping assistance services. Namely, we address the impact of anthropomorphic design metaphors on brand trust and brand experience in people-processing (e.g., back massage) and mental-stimulus-processing (e.g., shopping assistance) service contexts, as compared with possession-processing (e.g., shopping cart service) and information-processing (e.g., security services) service contexts. Finally, with Study 3 we test whether the proposed brand effects hold in real life. In a field study ($n = 393$), we also consider the impact of anthropomorphic design metaphors on

other firm-related outcomes; relationship variables such as attitudinal loyalty, WOM, and store patronage; and spending behavior, measured as the number of items purchased, purchase volume, and overspending.

5 | STUDY 1: IMPACT OF ANTHROPOMORPHIC DESIGN METAPHORS ON CORPORATE BRAND PERCEPTIONS

5.1 | Study design

With a stimulus-based scenario study, we investigate the effect of the perceived presence of anthropomorphic design metaphors on two corporate brand perceptions: brand trust and brand experience. As suggested by Dang and Liu (2023), the stimuli comprise two visual representations of robots, one with a highly anthropomorphic design, with a humanoid face and a human-shaped body (strong presence of anthropomorphic design metaphors), and another with no or weak anthropomorphic features (weak presence of anthropomorphic design metaphors). In a pretest ($n = 32$), with a short survey, we measured the perceived presence of an anthropomorphic design metaphor using a validated measurement of perceived anthropomorphism (Bartneck et al., 2009). The pretest affirmed that the robot was perceived as significantly different in the presence of anthropomorphic design metaphors ($M_{\text{strong}} = 4.78$, $SD = 0.56$; $M_{\text{weak}} = 2.63$, $SD = 1.47$; $t = 5.47$; $p < 0.001$).

For the main study, we collected data from a U.S. survey panel. In the 2×1 between-subjects experimental design, we manipulated the strong or weak presence of anthropomorphic design metaphors with the pretested stimuli. Participants were randomly assigned to one of the scenarios, with equal group sizes, and were instructed to read the scenario description carefully and place themselves in the role of the customer interacting with such a robot in a generic service encounter. To avoid confounds with other service or robot brands, we used a hypothetical brand name that emphasized the service context (Keller & Aaker, 1992): SERVITO™. We asked the participants to provide their impressions of the fictional brand, using measures adapted to the study context (Web Appendix A, Table A). The study's design and stimuli are detailed in Web Appendix B, Panel A. We used validated scales for brand trust (Chaudhuri & Holbrook, 2001) and brand experience (Brakus et al., 2009).

5.2 | Results

Among the 110 participants who completed the survey, we retained 109 responses, from 40 men and 69 women,

whose average age was 31 years. An analysis of variance confirmed that the strong presence of anthropomorphic design metaphors led to significantly greater brand trust than the weak presence ($M_{\text{strong}} = 3.09$, $SD = 0.79$; $M_{\text{weak}} = 2.39$, $SD = 0.94$; $t = 4.23$; $p < 0.001$). In addition, the strong anthropomorphic design metaphor evoked significantly greater brand experiences on two dimensions: sensual ($M_{\text{strong}} = 3.48$, $SD = 1.03$; $M_{\text{weak}} = 2.89$, $SD = 1.13$; $t = 2.87$; $p < 0.05$) and intellectual ($M_{\text{strong}} = 3.20$, $SD = 1.08$; $M_{\text{weak}} = 2.72$, $SD = 1.09$; $t = 2.30$; $p < 0.05$). However, the impact of anthropomorphic robot design on affective ($M_{\text{strong}} = 2.45$, $SD = 1.00$; $M_{\text{weak}} = 2.30$, $SD = 1.13$) and behavioral ($M_{\text{strong}} = 2.65$, $SD = 1.02$; $M_{\text{weak}} = 2.57$, $SD = 1.02$) brand experiences was not significant. We thus find support for Hypothesis 1 and partial support for Hypothesis 2.

The lack of effect of anthropomorphic design metaphors on affective and behavioral brand experiences might result because typical uses of robots in service contexts aim to provide entertaining encounters, with superficial dialog and no bodily interactions. But as we have discussed, anthropomorphic robots can offer various services, beyond entertainment. Therefore, to explore whether our findings depend on the service context, including the entertainment-focused uses of robots in the service industry, we test the effects of anthropomorphic design metaphors in service robots in different, specific service contexts.

6 | STUDY 2: IMPACT OF SERVICE CONTEXTS ON THE EFFECT OF ANTHROPOMORPHIC DESIGN METAPHORS

To determine if the effect of anthropomorphic design metaphors on corporate brand perceptions holds for the different types of service a robot might offer, we test the influence of four service contexts: people-processing, possession-processing, mental-stimulus-processing, and information-processing (Wirtz et al., 2013). That is, we complement our consideration of the effects of the presence of an anthropomorphic design metaphor, as an independent variable, by including four robot perceptions identified in prior human–robot interaction literature.

6.1 | Study design and manipulations

As suggested by Victorino et al. (2012), video studies in service contexts should enable participants to form realistic assessments of the scenario and offer responses that match those that participants in field studies would

provide (Bateson & Hui, 1992). MacDorman (2006) also indicates that video clips can offer appropriate, authentic presentations of the appearance and performance of embodied robots. Accordingly, videos and pictures are common sources in human–robot interaction research (Cheng, 2023). Video studies of embodied robots often feature different (i.e., 10–40) robot representations to reflect the considerable variety available in real life (Rosenthal-von der Pütten & Krämer, 2014; Ho & MacDorman, 2010; Kamide et al., 2015). Therefore, we collected more than 80 videos of robots performing in various service contexts; through discussion, we narrowed this pool to 16 videos. Three academic experts assigned the videos, according to Wirtz et al.'s (2013) classification, to people-processing (e.g., back massage), possession-processing (e.g., shopping cart), mental-stimulus-processing (e.g., shopping assistance), or information-processing (e.g., security) services, such that four videos represented each service context. Their initial agreement rate reached 95.83%. We edited the videos to highlight a typical scene in which the embodied robot interacted with a customer and reduced any noisy focus on the environment or other actors. Each video was diagnostic of the context and was accompanied by a description of the service provided. When asked to classify these videos, the survey participants also indicated a high agreement rate of 86.46%. When we used participants' assessments to calculate the intra-class correlation, or the proportion of within-category variance to total variance (Raudenbush & Bryk, 2002), we obtained a value of 0.61, so 61% of the variance occurred among the four service categories, and 39% was within them. Thus, the classification appears appropriate (Homburg & Fürst, 2005).

The videos and a short, context-specific introduction were included in an online survey questionnaire. For example, participants assigned randomly to the mental-stimulus-processing condition were asked to imagine they were looking for shopping advice. As in Study 1, we used the hypothetical brand SERVITO™ for all 16 service scenarios (Web Appendix B Panel B). Every video started with a short, 7-s introduction to the brand (e.g., “SERVITO™ proudly presents a new robot performing shopping advice”), followed by a 20-s video of the typical service scene. After watching the video, an attention check required participants to describe the robot's actions.

6.2 | Data collection and measurements

We collected the data using a U.S. survey panel. The study participants were randomly assigned to the 16 scenarios with equal group sizes. The sampling required that half of the 530 study participants were older than

35 years. In addition, 42.1% of the sample were women. The conceptualization and construct items came from prior research, as follows: anthropomorphic design metaphor (Bartneck et al., 2009), brand experience (Brakus et al., 2009), and brand trust (Chaudhuri & Holbrook, 2001). They were adapted to the study context. We pretested the questionnaire with five Ph.D. students before testing it further among 30 customers. The measurements emerged as reliable and valid (Web Appendix A, Table A). As in Study 1, we measured the perceived presence of anthropomorphic design metaphors using a validated scale of perceived anthropomorphism (Bartneck et al., 2009). We added four other robot perceptions, known as the Godspeed characteristics, as control variables: animacy, likeability, perceived intelligence, and perceived safety (Bartneck et al., 2009). For all constructs, the Cronbach's alpha scores exceeded the threshold value of 0.70 (Nunnally, 1978), composite reliability scores were greater than 0.60 (Bagozzi & Yi, 1988), and the average variance extracted (AVE) exceeded 0.50. In addition, discriminant validity was confirmed according to the criteria proposed by Fornell and Larcker (1981; Web Appendix A, Table B).

6.3 | Results

We used structural equation modeling in Mplus to test Hypothesis 1–Hypothesis 4. The results (Table 1, Panel A) suggest that the model fits the data well (confirmatory fit index [CFI] = 0.92; Tucker-Lewis index [TLI] = 0.91; root mean square error of approximation [RMSEA] = 0.05; standardized root mean residual [SRMR] = 0.05; χ^2 [df] = 15,664[1125]). It also illustrates that the strong presence of anthropomorphic design metaphors relates positively to brand trust and brand experience. In line with our Study 1 findings, the presence of anthropomorphic design metaphors exhibits a positive association with brand trust ($\gamma = 0.16$, $p < 0.01$), in support of Hypothesis 1. Moreover, in this study, it is positively linked with all four brand experience dimensions: sensual ($\gamma = 0.12$, $p < 0.05$), affective ($\gamma = 0.30$, $p < 0.01$), behavioral ($\gamma = 0.14$, $p < 0.05$), and intellectual ($\gamma = 0.09$, $p < 0.10$), as we predicted in Hypothesis 2a–d. In addition to the influence of the control variables in Table 1 (need for interaction, affiliative tendency, playfulness) and the dummy-coded service types, we tested several other control variables. Many robots are still in beta development, and prior studies include customers' negative attitudes toward robots (NARS; Syrdal et al., 2009) as a control variable, together with socio-demographic features (age, gender, income). When we include these controls, the results remain the same.

To check if the effects of anthropomorphic design metaphors are generalizable across service contexts, we add interaction terms to the model (Table 1). The interaction variables are mean-centered. Because the service contexts are dummy-coded, each variable can be represented as a linear combination with the others. Thus, one of the four service contexts must be excluded from the interaction tests, to act as a reference category. The results in Panel B, Table 1, reveal that several of the predicted interactions affect corporate brand outcomes. Specifically, as predicted in Hypothesis 3b, the relationship between an anthropomorphic design metaphor and brand trust is stronger for mental-stimulus-processing services ($\gamma = 0.12$, $p < 0.01$). In support of Hypothesis 4b, the effects of anthropomorphic design metaphors are stronger on affective ($\gamma = 0.17$, $p < 0.01$), behavioral ($\gamma = 0.11$, $p < 0.10$), and intellectual ($\gamma = 0.15$, $p < 0.01$) brand experiences in the mental-stimulus-processing services context. In line with Hypothesis 4a, we observe a stronger relationship between an anthropomorphic design metaphor and both affective ($\gamma = 0.19$, $p < 0.01$) and intellectual ($\gamma = 0.16$, $p < 0.01$) experiences for people-processing services. However, we cannot confirm Hypothesis 4c: Contrary to our hypothesis, the relationship of anthropomorphic design metaphors with behavioral brand experiences is stronger for possession-processing services ($\gamma = 0.08$, $p < 0.10$).

7 | STUDY 3: VALIDATING THE EFFECT OF ANTHROPOMORPHIC DESIGN METAPHORS

In Study 3, we aim to replicate the scenario-based findings of Studies 1 and 2 and test whether the effect of anthropomorphic design metaphors on brand perceptions holds in real-life contexts. For this effort, we investigate the retail context, which supports tests of a more comprehensive array of corporate brand perception and firm-related outcomes.

7.1 | Study design

We conducted an observational field survey study with the embodied robot Pepper at an apparel store (Web Appendix B, Figure C), involving two surveys (1a and 1b) and an observational study. First, we approached store visitors at the store entrance and asked about their general attitudes to robots; preexisting biases exist and might affect such general attitudes (Syrdal et al., 2009). Survey participation was voluntary, and each participant received a 10% discount on their shopping basket in

TABLE 1 Results of structural equation modeling (Study 2).

| Panel A: Main effects | | | |
|---|-------|------|---------|
| Relationship | B | SE | p-value |
| Brand trust | | | |
| Anthropomorphic design metaphor → Brand trust (Hypothesis 1) | 0.16 | 0.07 | 0.00 |
| Controls | | | |
| People-processing services → Brand trust | 0.03 | 0.05 | 0.25 |
| Possession-processing services → Brand trust | 0.03 | 0.05 | 0.25 |
| Mental-stimulus-processing services → Brand trust | −0.02 | 0.05 | 0.36 |
| Animacy → Brand trust | −0.11 | 0.11 | 0.10 |
| Likeability → Brand trust | 0.19 | 0.11 | 0.01 |
| Intelligence → Brand trust | 0.30 | 0.11 | 0.00 |
| Safety → Brand trust | 0.18 | 0.05 | 0.00 |
| Need for interaction → Brand trust | 0.05 | 0.06 | 0.17 |
| Affiliative tendency → Brand trust | −0.10 | 0.06 | 0.02 |
| Playfulness → Brand trust | 0.17 | 0.07 | 0.00 |
| Sensual brand experience | | | |
| Anthropomorphic design metaphor → Sensual brand experience (Hypothesis 2a) | 0.12 | 0.08 | 0.05 |
| Controls | | | |
| People-processing services → Sensual brand experience | −0.01 | 0.05 | 0.42 |
| Possession-processing services → Sensual brand experience | 0.06 | 0.05 | 0.10 |
| Mental-stimulus-processing services → Sensual brand experience | −0.07 | 0.05 | 0.07 |
| Animacy → Sensual brand experience | 0.01 | 0.12 | 0.47 |
| Likeability → Sensual brand experience | 0.25 | 0.11 | 0.00 |
| Intelligence → Sensual brand experience | 0.17 | 0.09 | 0.00 |
| Safety → Sensual brand experience | 0.09 | 0.06 | 0.06 |
| Need for interaction → Sensual brand experience | 0.05 | 0.06 | 0.16 |
| Affiliative tendency → Sensual brand experience | −0.04 | 0.06 | 0.20 |
| Playfulness → Sensual brand experience | 0.23 | 0.07 | 0.00 |
| Affective brand experience | | | |
| Anthropomorphic design metaphor → Affective brand experience (Hypothesis 2b) | 0.30 | 0.09 | 0.00 |
| Controls | | | |
| People-processing services → Affective brand experience | −0.07 | 0.05 | 0.09 |
| Possession-processing services → Affective brand experience | −0.03 | 0.05 | 0.25 |
| Mental-stimulus-processing services → Affective brand experience | −0.03 | 0.06 | 0.28 |
| Animacy → Affective brand experience | −0.10 | 0.13 | 0.14 |
| Likeability → Affective brand experience | 0.23 | 0.13 | 0.01 |
| Intelligence → Affective brand experience | 0.11 | 0.11 | 0.06 |
| Safety → Affective brand experience | −0.05 | 0.06 | 0.20 |
| Need for interaction → Affective brand experience | 0.10 | 0.06 | 0.04 |
| Affiliative tendency → Affective brand experience | −0.10 | 0.07 | 0.03 |
| Playfulness → Affective brand experience | 0.21 | 0.07 | 0.00 |

(Continues)

TABLE 1 (Continued)

| Panel A: Main effects | | | | | |
|---|--------------------------|----------------------------|-----------------------------|-------------------------------|---------------------------|
| Relationship | | B | SE | p-value | |
| Behavioral brand experience | | | | | |
| Anthropomorphic design metaphor → Behavioral brand experience (Hypothesis 2c) | | 0.14 | 0.09 | 0.03 | |
| Controls | | | | | |
| People-processing services → Behavioral brand experience | | 0.07 | 0.06 | 0.09 | |
| Possession-processing services → Behavioral brand experience | | −0.04 | 0.06 | 0.21 | |
| Mental-stimulus-processing services → Behavioral brand experience | | 0.00 | 0.06 | 0.49 | |
| Animacy → Behavioral brand experience | | 0.06 | 0.13 | 0.27 | |
| Likeability → Behavioral brand experience | | 0.07 | 0.12 | 0.24 | |
| Intelligence → Behavioral brand experience | | 0.14 | 0.12 | 0.04 | |
| Safety → Behavioral brand experience | | 0.09 | 0.06 | 0.06 | |
| Need for interaction → Behavioral brand experience | | 0.05 | 0.07 | 0.17 | |
| Affiliative tendency → Behavioral brand experience | | −0.03 | 0.07 | 0.26 | |
| Playfulness → Behavioral brand experience | | 0.19 | 0.08 | 0.00 | |
| Intellectual brand experience | | | | | |
| Anthropomorphic design metaphor → Intellectual brand experience (Hypothesis 2d) | | 0.09 | 0.09 | 0.09 | |
| Controls | | | | | |
| People-processing services→ Intellectual brand experience | | 0.01 | 0.06 | 0.43 | |
| Possession-processing services→ Intellectual brand experience | | −0.02 | 0.06 | 0.39 | |
| Mental-stimulus-processing services→ Intellectual brand experience | | −0.11 | 0.06 | 0.01 | |
| Animacy → Intellectual brand experience | | 0.13 | 0.13 | 0.06 | |
| Likeability → Intellectual brand experience | | 0.02 | 0.12 | 0.41 | |
| Intelligence→ Intellectual brand experience | | 0.22 | 0.13 | 0.00 | |
| Safety → Intellectual brand experience | | 0.03 | 0.06 | 0.30 | |
| Need for interaction→ Intellectual brand experience | | 0.08 | 0.07 | 0.07 | |
| Affiliative tendency→ Intellectual brand experience | | −0.06 | 0.07 | 0.12 | |
| Playfulness→ Intellectual brand experience | | 0.21 | 0.09 | 0.00 | |
| Panel B: Summary of moderator tests | | | | | |
| Independent Variable | Dependent variable | | | | |
| | Sensual Brand Experience | Affective Brand Experience | Behavioral Brand Experience | Intellectual Brand Experience | Brand Trust |
| Anthropomorphic design metaphor | — | People (Hypothesis 4a: +) | Possession (+) | People (Hypothesis 4a: +) | Mental (Hypothesis 3b: +) |
| | | Mental (Hypothesis 4b: +) | Mental (Hypothesis 4b: +) | Mental (Hypothesis 4b: +) | |

Note: Information-processing services are the reference category. The table displays standardized estimates. Model fit: CFI = 0.92; TLI = 0.91; RMSEA = 0.05; SRMR = 0.05; χ^2 (df) = 15,664(1125). People = people-processing service context; Mental = mental-stimulus-processing service context; Possession = possession-processing service context. Dash indicates that the robot characteristic has the same effects, independent of service type.

return for participation. Before they saw Pepper in the store, Survey 1a collected participants' planned shopping budget. Second, the participants were randomly assigned to one of six scripts³ and encouraged to interact with Pepper using their simple script, including three or four potential questions, which we used to facilitate and support their interactions. During these interactions, participants were observed by trained observers who completed an observation protocol, allowing us to confirm whether participants followed the script. Third, participants finished Survey 1b after their interaction with Pepper, which contained questions about the exchange and measures of their brand perceptions. As in Studies 1 and 2, we measured the perceived presence of the anthropomorphic design metaphor with a perceived anthropomorphism scale that has been successfully validated (Destephe et al., 2015). Due to time constraints, we relied on single-item scales for attitudinal loyalty ("I consider myself loyal to [name of firm]"), WOM ("I would recommend [name of firm] to other people"), and patronage intentions ("The likelihood that I will shop in this store again is very high"). We also included brand trust and brand experience scales, adapted to the retail context (Brakus et al., 2009).⁴ Moreover, we controlled for participants' expressed NARS, which we had collected in Survey 1a (Syrdal et al., 2009). Web Appendix A Table C lists all measurement items. Finally, the retailer gathered the sales receipts of customers who cashed in the discount vouchers, each with an identification number that allowed us to link the receipts to Surveys 1a and 1b and the observation protocol for each customer. The sales receipts indicated both the purchase volume and number of items bought.

7.2 | Results

A total of 501 participants completed Survey 1a, of whom 430 interacted with Pepper and 429 completed Survey 1b. From the 429 cases, we removed 36 due to outside interference, noted by the observers, or contradictions

between observed and self-reported behavior, resulting in a final sample of 393 cases. Of these, 95 were men and 296 were women, and their average age was 45 years. In support of convergent validity (Hulland, 1999), each item loaded significantly on its respective constructs, and none of the items loaded below the cut-off value of 0.50. The Cronbach's alpha scores exceeded 0.70 (Nunnally, 1978), the composite reliability scores were greater than 0.66 (Bagozzi & Yi, 1988), and the AVE scores exceeded 0.50 (Web Appendix A, Table C).

Similar to Brakus et al. (2009), we find high correlations between two brand experience dimensions.⁵ Discriminant validity was confirmed for most variables (Fornell & Larcker, 1981): The square root of the AVE of each construct was greater than its correlations with all the other constructs, and the correlation of each item with its intended construct was greater than its correlations with other constructs (Web Appendix A, Table D). As the only exception, the correlations of intellectual brand experience with brand trust, sensory brand experience, and affective brand experience barely missed the first criterion. In a χ^2 difference test (Bagozzi & Phillips, 1982), the confirmatory factor analysis produced a significant increase in the χ^2 statistic in every instance ($\Delta\chi^2$ values with 1 df were all significant at $p < 0.05$), indicating high discriminant validity across constructs.⁶ Thus, the validity of the measures for our constructs appears good.

We used structural equation modeling in Mplus to test our hypotheses about the impact of anthropomorphic design metaphors on corporate brand perception and firm-related outcomes. The analysis suggested good model fit (CFI = 0.94; TLI = 0.92; RMSEA = 0.05; SRMR = 0.05). We also controlled for negative attitudes toward robots, age, gender, and variations in the scripts (i.e., question type, empathy, touch request). Furthermore, we tested the impact of the anthropomorphic design metaphor on spending behavior among a subset of the overall sample, involving 149 customers for whom we had corresponding sales receipts.

As the results in Table 2 show, we can validate the effect of the anthropomorphic design metaphor on corporate brand perceptions in a real-life context. The positive impact of anthropomorphic robot designs on corporate brand perceptions includes a positive effect on brand

³These scripts contained some necessary variances. For example, participants could ask Pepper where children's clothes were located ("Where can I find the children's department?") or where to find staff who could inform them about winter jackets ("Who can advise me on the latest winter jackets?"). In some scripts, Pepper was empathetic and asked participants how they were and acted accordingly (Mumm & Mutlu, 2011). In others, Pepper asked participants to touch it (Peck & Childers, 2003). We controlled for all three variables in the analyses.

⁴We deleted two items—one from the sensual brand experience and another from the intellectual brand experience scale—that were measured with multiple items, to shorten the survey and encourage more participants to complete it.

⁵Brakus et al. (2009) observe similar correlations among brand experience dimensions. In two cases, our correlations are significantly lower than in the original study; in two cases, the correlations are the same; and in two cases, they are slightly higher. The average correlations across dimensions were $r = 0.64$ in our study and $r = 0.69$ in the original article.

⁶We also estimated a model with brand experience as a second-order construct, which consistently indicates strong effects of anthropomorphic design metaphors on brand experience and brand trust.

TABLE 2 Results of structural equation modeling (Study 3).

| Relationship | B | SE | p-Value |
|--|-------|------|---------|
| Corporate brand perception | | | |
| Brand trust | | | |
| Anthropomorphic design metaphor → Brand trust (Hypothesis 1) | 0.09 | 0.07 | 0.08 |
| Controls | | | |
| NARS → Brand trust | −0.07 | 0.07 | 0.33 |
| Age → Brand trust | 0.01 | 0.00 | 0.11 |
| Gender → Brand trust | −0.22 | 0.13 | 0.09 |
| Script type → Brand trust | −0.09 | 0.14 | 0.52 |
| Empathy → Brand trust | −0.10 | 0.16 | 0.52 |
| Touch request → Brand trust | −0.01 | 0.14 | 0.95 |
| Sensual brand experience | | | |
| Anthropomorphic design metaphor → Sensual brand experience (Hypothesis 2a) | 0.15 | 0.07 | 0.01 |
| Controls | | | |
| NARS → Sensual brand experience | −0.12 | 0.07 | 0.04 |
| Age → Sensual brand experience | 0.00 | 0.00 | 0.82 |
| Gender → Sensual brand experience | −0.38 | 0.13 | 0.00 |
| Script type → Sensual brand experience | −0.10 | 0.14 | 0.50 |
| Empathy → Sensual brand experience | −0.12 | 0.16 | 0.47 |
| Touch request → Sensual brand experience | −0.13 | 0.14 | 0.36 |
| Affective brand experience | | | |
| Anthropomorphic design metaphor → Affective brand experience (Hypothesis 2b) | 0.19 | 0.06 | 0.00 |
| Controls | | | |
| NARS → Affective brand experience | −0.20 | 0.07 | 0.00 |
| Age → Affective brand experience | −0.01 | 0.01 | 0.06 |
| Gender → Affective brand experience | −0.13 | 0.13 | 0.32 |
| Script type → Affective brand experience | −0.20 | 0.14 | 0.16 |
| Empathy → Affective brand experience | −0.32 | 0.16 | 0.04 |
| Touch request → Affective brand experience | 0.02 | 0.14 | 0.90 |
| Behavioral brand experience | | | |
| Anthropomorphic design metaphor → Behavioral brand experience (Hypothesis 2c) | 0.12 | 0.07 | 0.04 |
| Controls | | | |
| NARS → Behavioral brand experience | −0.13 | 0.07 | 0.07 |
| Age → Behavioral brand experience | 0.01 | 0.00 | 0.00 |
| Gender → Behavioral brand experience | −0.09 | 0.14 | 0.53 |
| Script type → Behavioral brand experience | −0.09 | 0.14 | 0.52 |
| Empathy → Behavioral brand experience | −0.10 | 0.16 | 0.52 |
| Touch request → Behavioral brand experience | 0.01 | 0.15 | 0.93 |
| Intellectual brand experience | | | |
| Anthropomorphic design metaphor → Intellectual brand experience (Hypothesis 2d) | 0.26 | 0.12 | 0.02 |

TABLE 2 (Continued)

| Relationship | B | SE | p-Value |
|---|-------|------|---------|
| <i>Controls</i> | | | |
| NARS → Intellectual brand experience | −0.36 | 0.14 | 0.01 |
| Age → Intellectual brand experience | 0.00 | 0.01 | 0.06 |
| Gender → Intellectual brand experience | 0.15 | 0.23 | 0.32 |
| Script type → Intellectual brand experience | −0.17 | 0.24 | 0.46 |
| Empathy → Intellectual brand experience | −0.26 | 0.28 | 0.35 |
| Touch request → Intellectual brand experience | 0.22 | 0.24 | 0.36 |
| Firm relationship | | | |
| <i>Attitudinal loyalty</i> | | | |
| Anthropomorphic design metaphor → Attitudinal loyalty (Hypothesis 6a) | 0.06 | 0.06 | 0.17 |
| <i>Controls</i> | | | |
| NARS → Attitudinal loyalty | −0.09 | 0.05 | 0.07 |
| Age → Attitudinal loyalty | −0.01 | 0.00 | 0.06 |
| Gender → Attitudinal loyalty | −0.05 | 0.12 | 0.69 |
| Script type → Attitudinal loyalty | 0.06 | 0.12 | 0.62 |
| Empathy → Attitudinal loyalty | −0.03 | 0.14 | 0.83 |
| Touch request → Attitudinal loyalty | −0.07 | 0.12 | 0.57 |
| <i>WOM</i> | | | |
| Anthropomorphic design metaphor → WOM (Hypothesis 6b) | 0.07 | 0.05 | 0.07 |
| <i>Controls</i> | | | |
| NARS → WOM | −0.09 | 0.05 | 0.07 |
| Age → WOM | 0.00 | 0.00 | 0.41 |
| Gender → WOM | −0.14 | 0.10 | 0.16 |
| Question type → WOM | 0.04 | 0.10 | 0.74 |
| Empathy → WOM | 0.06 | 0.12 | 0.60 |
| Touch request → WOM | −0.06 | 0.10 | 0.58 |
| <i>Patronage</i> | | | |
| Anthropomorphic design metaphor → Patronage (Hypothesis 6c) | 0.06 | 0.04 | 0.08 |
| <i>Controls</i> | | | |
| NARS → Patronage | −0.01 | 0.05 | 0.86 |
| Age → Patronage | 0.00 | 0.00 | 0.31 |
| Gender → Patronage | −0.14 | 0.09 | 0.13 |
| Script type → Patronage | 0.07 | 0.10 | 0.48 |
| Empathy → Patronage | 0.10 | 0.11 | 0.60 |
| Touch request → Patronage | −0.05 | 0.09 | 0.58 |
| Shopping assessment | | | |
| <i>Shopping enjoyment</i> | | | |
| Anthropomorphic design metaphor → Shopping enjoyment | 0.09 | 0.05 | 0.03 |
| <i>Controls</i> | | | |
| NARS → Shopping enjoyment | −0.06 | 0.05 | 0.28 |
| Age → Shopping enjoyment | 0.00 | 0.00 | 0.86 |

(Continues)

TABLE 2 (Continued)

| Relationship | <i>B</i> | SE | <i>p</i> -Value |
|---|----------|------|-----------------|
| Gender → Shopping enjoyment | −0.20 | 0.10 | 0.04 |
| Script type → Shopping enjoyment | −0.03 | 0.10 | 0.80 |
| Empathy → Shopping enjoyment | 0.05 | 0.10 | 0.62 |
| Touch request → Shopping enjoyment | −0.01 | 0.10 | 0.89 |
| Shopping satisfaction | | | |
| Anthropomorphic design metaphor → Shopping satisfaction | 0.05 | 0.04 | 0.10 |
| Controls | | | |
| NARS → Shopping satisfaction | −0.08 | 0.04 | 0.06 |
| Age → Shopping satisfaction | 0.00 | 0.00 | 0.50 |
| Gender → Shopping satisfaction | −0.08 | 0.08 | 0.32 |
| Script type → Shopping satisfaction | 0.02 | 0.09 | 0.85 |
| Empathy → Shopping satisfaction | 0.05 | 0.10 | 0.62 |
| Touch request → Shopping satisfaction | −0.10 | 0.09 | 0.27 |

Note: NARS = negative attitudes toward robots. The table displays standardized estimates. Model fit: CFI = 0.94; TLI = 0.92; RMSEA = 0.05; SRMR = 0.05; χ^2 (df) = 658(348).

trust ($\beta = 0.09$, $p < 0.10$), in support of Hypothesis 1. The presence of anthropomorphic design metaphors also strongly affects all brand experience dimensions: sensual ($\beta = 0.15$, $p < 0.05$), affective ($\beta = 0.19$, $p < 0.01$), behavioral ($\beta = 0.12$, $p < 0.05$), and intellectual ($\beta = 0.26$, $p < 0.05$). Thus, Hypothesis 2 is supported. Notably, the anthropomorphic design metaphor has the strongest impact on intellectual brand experience, indicating that a humanlike embodied robot does not seem like an ordinary encounter; its newness still stimulates strong cognitive responses from customers.

Moreover, the presence of the anthropomorphic design metaphor has pertinent impacts on other firm-related outcomes, especially the relationship outcomes. That is, the anthropomorphic design metaphor does not appear to influence spending behavior, measured as purchase volume ($\beta = 0.06$, $p > 0.10$), number of products ($\beta = 0.02$, $p > 0.10$), or overspending behavior ($\beta = 0.02$, $p > 0.10$), such that we must reject Hypothesis 5a–c. It also does not significantly affect attitudinal loyalty (cf. Hypothesis 6a). But the effects on WOM ($\beta = 0.07$, $p < 0.10$) and store patronage ($\beta = 0.06$, $p < 0.10$) are significant, in support of Hypothesis 6b and c.⁷ Thus, our findings validate the effect of anthropomorphic design

metaphors on corporate brand perceptions in a real-life setting, signaling stronger impacts on brand experience ($\beta \geq 0.12$) than other firm-related outcomes ($\beta \leq 0.07$).

8 | GENERAL DISCUSSION

Our research strongly encourages NSD managers and scholars to consider the effects of introducing anthropomorphic service robots on corporate brands. Across three studies, we test the impact of robots' anthropomorphic design metaphors on different corporate brand outcomes, the moderating effects of various service contexts, and impacts on other firm-related outcomes. Table 3 summarizes the hypotheses and results, revealing the substantial evidence we provide of the influence of anthropomorphic design metaphors on corporate brand outcomes. In addition to confirming many of our predictions, we encountered some unexpected results that offer interesting learnings for scholars regarding the introduction of new services delivered by robots.

First, regarding *brand trust* (Hypothesis 1), all our studies support a positive influence of anthropomorphic design metaphors, such that they appear to increase social presence in HRI and help customers deal with unfamiliar scenarios, including business encounters with robots (Matzler et al., 2008). Scholars should apply social presence theory when studying anthropomorphic design metaphors. Regarding the *brand experience* (Hypothesis 2), the results are more nuanced, in that we find support for the effects of design metaphors on the

⁷We also tested the impact of the anthropomorphic design metaphor on shopping assessment measures that correlate closely with anthropomorphism in robots: shopping enjoyment and shopping satisfaction (Blut et al., 2021). In line with prior literature, an anthropomorphic design metaphor positively affects both shopping enjoyment ($\beta = 0.09$, $p < 0.05$) and shopping satisfaction ($\beta = 0.05$, $p < 0.10$).

TABLE 3 Hypotheses and results.

| # | Hypothesis | Study 1 | Study 2 | Study 3 |
|---------------------|---|--|--|--|
| Hypothesis 1 | The perceived presence of anthropomorphic design metaphors in service robots positively affects brand trust. | Supported | Supported | Supported |
| Hypothesis 2 | The perceived presence of anthropomorphic design metaphors in service robots positively affects (a) sensual, (b) affective, (c) behavioral, and (d) intellectual brand experience. | a. Supported b. Not supported c. Not supported d. Supported | a. Supported b. Supported c. Supported d. Supported | a. Supported b. Supported c. Supported d. Supported |
| Hypothesis 3 | The effect of the presence of anthropomorphic design metaphors on brand trust is stronger for (a) people-processing services and (b) mental-stimulus-processing services, whereas the effect is weaker for (c) possession-processing services and (d) information-processing services. | Not tested | a. Not supported b. Supported c. Not supported d. Not tested ^c | Not tested |
| Hypothesis 4 | The effect of the presence of anthropomorphic design metaphors on brand experience is stronger for (a) people-processing services and (b) mental-stimulus-processing services, whereas the effect is weaker for (c) possession-processing services and (d) information-processing services. | Not tested | a. Partially supported ^a b. Partially supported ^b c. Not supported d. Not tested ^c | Not tested |
| Hypothesis 5 | The perceived presence of anthropomorphic design metaphors in service robots positively affects (a) the number of products purchased, (b) the purchase volume, and (c) customers' overspending behavior. | Not tested | Not tested | a. Not supported b. Not supported c. Not supported |
| Hypothesis 6 | The perceived presence of anthropomorphic design metaphors in service robots positively affects (a) attitudinal loyalty, (b) positive WOM, and (c) store patronage. | Not tested | Not tested | a. Not supported b. Supported c. Supported |

^aSupported for affective and intellectual brand experience dimensions.^bSupported for affective, behavioral, and intellectual brand experience dimensions.^cInformation-processing services used as reference category.

four brand experience dimensions in Studies 2 and 3, but not Study 1, where the effects are significant on sensual and intellectual brand experiences but not on affective or behavioral brand experiences. We propose two potential explanations for the nonsignificant effect on affective brand experience in Study 1. As outlined in the development of Hypothesis 1, a very human-like robot might elicit the unpleasant uncanny valley effect (Mori et al., 2012), which could mitigate positive feelings toward the corporate brand. NSD scholars should explore this mediating role of eeriness when studying such design metaphors. Furthermore, a simple image of a robot might not convince customers of the robot's empathetic and emotionally sensitive nature, in line with research that suggests customers do not expect robots to express genuine and affective empathy (Kipnis et al., 2022; see the development of Hypothesis 2). The results related to the behavioral brand experience might be nonsignificant

for similar reasons. When presented with an image of a service robot, customers might be prompted to recall situations in which they have seen or encountered such robots, and those recollections might refer to scenarios in which the robot interaction required only minimal behavioral involvement, as is true of current applications of robot servers, robot greeters at stores, or robot guides at airports. These findings reemphasize the importance of using diverse methods to study design metaphor effects; scholars studying the effects of anthropomorphic design metaphors should complement simple scenario-based studies with additional video and field studies. Finally, considering that customers seemingly use the anthropomorphic design as a brand cue, leading to positive evaluations of the corporate brand (Brady et al., 2005), we advocate for more frequent measures of such firm-level outcomes and broader applications of cue utilization theory.

Second, the results involving the *moderating effects of service contexts* on the relationship between anthropomorphic design metaphors and corporate brand perceptions corroborate the strengthening impact of mental-stimulus-processing services on the relationship between anthropomorphic design metaphors and brand trust ([Hypothesis 3b](#)), as well as affective, behavioral, and intellectual brand experiences ([Hypothesis 4b](#)). Similarly, people-processing services enhance the relationships of anthropomorphic design metaphors with affective and intellectual brand experiences ([Hypothesis 4a](#)). These findings emphasize the significance of anthropomorphic design metaphors on corporate brand outcomes in service contexts in which customers are the direct recipients of the service, whether mentally or physically. This observation reinforces the argument that direct experiences actively engage customers and provide them with credible, concrete information about the brand and the firm (Wirtz et al., 2013). NSD scholars studying anthropomorphic design thus need to differentiate use contexts in which customers or their possessions are the objects of the service.

In parallel, we note that the moderating effects of mental-stimulus-processing and people-processing services depend on the brand outcome. We find no consistent evidence of an accelerated effect of anthropomorphic design metaphors on sensual brand experiences, nor do people-processing service contexts appear to strengthen the impact of anthropomorphic design metaphors on behavioral brand experiences and brand trust. These unexpected results might stem from the dominance of customers' affective and cognitive reactions, which could overshadow sensual and behavioral responses. Direct robot interactions may seem riskier than human exchanges, and such risk perceptions could evoke negative sentiments toward robots or fears of potential harm (Syrdal et al., 2009), prompting heightened affective and cognitive responses. Studies that explore risk-based service classifications might help clarify these differences in the effects of anthropomorphic design metaphors on specific outcomes.

Another related and interesting observation relates to possession-processing services; we did not find evidence of a diminishing influence on the relationship of anthropomorphic design metaphors with brand trust ([Hypothesis 3c](#)) or brand experience ([Hypothesis 4c](#)). Customers seem more engaged with and observant of design features and the overall brand context when they are the primary beneficiaries of the service. In contrast, their involvement seems to diminish when the service targets their possessions (Wirtz et al., 2013). Scholars researching new services should delve deeper into these nuances, to learn if the impact of design metaphors varies for specific types of possessions, such as high-involvement products.

Third, we validate the advantageous effects of anthropomorphic design metaphors on *other firm-related outcomes*, such that customers' positive perceptions of new service robots embodying anthropomorphic design metaphors extend to the firm that introduces them. Employing these design metaphors correlates specifically with heightened intentions to revisit the store ([Hypothesis 6c](#)) and voice positive WOM ([Hypothesis 6b](#)). Customers also appreciate their interactions with anthropomorphic robots, leading to increased shopping enjoyment and satisfaction. Research into design metaphor effects thus should consider firm-related outcomes other than corporate brand perceptions. Yet our findings do not indicate effects of anthropomorphic design metaphors on customers' spending patterns ([Hypothesis 5](#)). Even if anthropomorphic designs do not directly influence spending behavior, a robust brand, superior customer experience, and strengthened relationship with the service provider arguably should lead to higher revenues in the long run (Grewal et al., 2009). These aspects warrant further exploration, perhaps in longitudinal studies.

9 | IMPLICATIONS

9.1 | Theoretical implications

In more detail, our research contributes to two main literature streams, pertaining to (1) the influence of design metaphors on customers and (2) anthropomorphism in service robots. For these specific research domains, we highlight some noteworthy contributions. For innovation literature, we reveal some notable consumer reactions to innovative design metaphors (Bloch, 1995). In turn, our study advances design metaphor theory by investigating their ramifications at the corporate brand level, as a result of customers' assessments. In this way, our study broadens the scope beyond customer responses to product-centered design metaphors, such as perceptions of durability, ease of use, or prestige (Bloch, 1995; Luchs & Swan, 2011). As we illustrate, customers often rely on the anthropomorphic design metaphor for their brand evaluations. Our findings indicate that anthropomorphic robots not only provide shopping assistance but also can function as product promoters and brand ambassadors. Of particular note, we substantiate the notion of spillover effects (Simonin & Ruth, 1998), triggered by design metaphors. The design attributes of the robot influence the corporate brand that introduces it.

Our study also responds to calls (e.g., Blut et al., 2021) for further research into the effects of robot anthropomorphism on brand outcomes and specific contexts in which anthropomorphism is most crucial. As we show,

positive consumer perceptions of anthropomorphic design metaphors reverberate with the brand, enhancing brand trust and overall brand experience. Our study also builds on Noble et al.'s (2013) comparison of the effects of anthropomorphic versus nonanthropomorphic design metaphors. They find that anthropomorphic design metaphors enhance the vividness of the product brand and brand differentiation; we test the effects on an extended set of outcomes, including corporate brand perception (e.g., brand experience, brand trust) and other firm-related outcomes (e.g., patronage behavior, sales). Existing research convincingly establishes that design metaphors influence product brands; we demonstrate their influences beyond the product level. Literature across multiple domains, such as innovation (Luchs & Swan, 2011), branding (Aaker, 2004), and marketing and management (Baumeister et al., 2015), highlights the significance of distinguishing between product and corporate brands. We demonstrate, in turn, that anthropomorphic design metaphors influence perceptions of the corporate brand of a firm that introduces service robots. Such findings emphasize the profound impact of design metaphors on higher-level perceptions, such as the corporate brand, which represents the organizational level. These insights advance design metaphor theory while also offering scholarly guidance about which outcomes to study when testing the influences of anthropomorphic design metaphors.

The findings deepen our comprehension of the contextual factors that can augment or attenuate the influence of anthropomorphic design metaphors in service robots. We validate the brand effects of anthropomorphic design metaphors across various service contexts, clarifying their potential applicability and identifying how contextual differences can determine design metaphors' effects on corporate brands. When McLeay et al. (2021) investigate the influence of anthropomorphic metaphors on brand usage intentions and test for service type differences (experience vs. credence services), they find no significant differences. By using the service context classification proposed by Wirtz et al. (2013), which introduces the nature of the service recipient (human or object), we help enrich the literature on design metaphors by identifying contexts in which the impact of anthropomorphic design metaphors is most likely to yield desired brand outcomes, namely, in people-related contexts. These insights advance design metaphor theory and reveal meaningful contextual differences that scholars should consider.

Our research employs a multistudy, multimethod approach to enrich our understanding of the potency of anthropomorphic design metaphors in service robots.

Acknowledging the mixed empirical findings observed in previous work (Velasco et al., 2021), we help establish that anthropomorphic design metaphors in service robots influence the brand that introduces these robots. Whereas prior research primarily has relied on experimental environments and fictional brands (Choi et al., 2022), our study goes beyond testing primary effects in experimental or hypothetical scenarios. It also includes a field study with an existing brand, thereby providing a more comprehensive validation of the findings.

9.2 | Practical implications

This study has implications for both NSD managers and robot designers. It underscores the significance of anthropomorphic design metaphors, especially when used to fabricate differentiated, desirable service robots that service providers can introduce into the marketplace. These customized robots should reflect future deployment possibilities, because design metaphors can be effective instruments for not only enhancing the user experience but also generating enduring effects on the brand, beyond short-term entertainment effects onsite. As a powerful tool, NSD managers should leverage design metaphors to enhance esthetic appeal and symbolic use simultaneously.

Many firms have invested in humanlike robots, such as Pepper, in pursuit of branding-related objectives (Rieland, 2019). Even when NSD managers acknowledge these robots' functional limitations, they continue investing in them to give customers a unique brand experience, and our study affirms this effort, because using such robots produces these outcomes. Humanoid robots in service encounters, especially if the customer is the direct service recipient, appear promising for brand building. In turn, we encourage NSD managers to select robots with anthropomorphic design metaphors and facilitate their direct interactions with customers to enhance shopping assessments and brand relationships. Anthropomorphic design metaphors also can contribute to consumer value, in that they increase the potential for positive outcomes associated with a brand, by informing and educating customers, with lower information costs, reduced risk perceptions, and greater process efficiency (Aaker, 2004; Erdem & Swait, 1998).

Even if introducing anthropomorphic robots does not directly increase sales, they can enhance customers' in-store shopping experience, which might result in increased store visit frequency or longer visit durations. Encounters with humanlike robots also can provide compelling and "Instagrammable" experiences for customers, from which the brand could benefit in the form of social media

network effects. Our study provides strategic guidance for NSD managers regarding the service contexts in which positive brand effects appear likely, namely, for firms offering people-processing and mental-stimulus-processing services. We recommend that NSD managers consider these subtleties and allow customers to engage directly with robots to enhance their appreciation of the interaction. Using robots to perform object-oriented tasks, such as parking lot surveillance, likely affects customers' brand experiences to significantly lesser degrees.

9.3 | Limitations and future research

This research is not without its limitations. First, we focus on perceived anthropomorphism as a robot characteristic that is communicated by design metaphors. Measures of perceived anthropomorphic design metaphors are critical; ambiguous design metaphors may lead to misinterpretations (Rompay & Thomas, 2008). Continued research should build on our efforts using varied methodologies, such as incorporating measures of designed anthropomorphism through manipulations and integrating additional methods that can yield more robust results.

Second, in a related sense, the anthropomorphic design metaphors we include all refer to human-like elements, but other design metaphors pertaining to animal- or plant-based concepts also might be pertinent. Noble et al. (2013) argue that animal-based metaphors could exert even more significant influences than anthropomorphic design metaphors in service robots. This point might be particularly relevant for promoting specific customer behaviors, such as sustainable behavior (Huang et al., 2020), which increases societal value. In this context, animal- or plant-based designs can metaphorically represent ecology and nature and, potentially, stimulate pro-environmental behavior (Huang et al., 2020; Tussyadiah & Miller, 2019). Animal-like robots such as a robotic dog that cleans up litter seemingly would be effective for reminding people not to litter themselves (Veolia Group, 2023). We hope continued NSD research investigates the effects of other design metaphors in service robots on outcomes that reflect both customer and societal value.

Third, additional research might consider other robot characteristics, such as their level of intelligence. The perceived intelligence of a robot likely would influence a customer's brand trust and the intellectual brand experience. However, Kipnis et al. (2022) note that service robots with advanced intelligence capabilities do not transform servicescapes for vulnerable consumers. We need research to define the most appropriate service

contexts for robots with AI components, as well as the design metaphors that can best enhance perceptions of intelligence.

Fourth, our finding that anthropomorphic design metaphors do not affect spending behavior suggests that a humanlike robot can enhance customer encounters and strengthen the brand, but it does not necessarily influence sales. Perhaps in other contexts, anthropomorphic design metaphors can result in higher sales or other spending outcomes, such as purchasing the products directly promoted by the robots.

Fifth, the scenario and video studies (Studies 1 and 2) have inherent limitations, which we sought to address with Study 3. As robots become more prevalent in service companies, we hope future NSD studies investigate other real HRI. However, such investigations must acknowledge and account for the brand's personality that introduces the robot. Choi et al. (2022) suggest customers may react negatively to high-contact robots when the brand has a sincere (vs. exciting) personality. Understanding how archetypal brand personalities mesh with anthropomorphic and other design metaphors represents an interesting topic for further research.

Sixth, we relied on the service classification proposed by Wirtz et al. (2013), which accounts for diverse customer responses to anthropomorphic design metaphors in the service contexts we study. Still, it might be insightful to test alternative classifications and typologies of service contexts, to enhance understanding of the generalizability of the observed effects. For example, McLeay et al. (2021) propose a credence–experience service framework. In such efforts, researchers should address the seemingly diminished relevance of anthropomorphic design metaphors when possessions represent the service objects. In these contexts, perceived risk likely is lower (i.e., they do not involve a person's body), and the interactions with the robot might be less immediate and direct. We hope that NSD research continues to investigate service contexts in which robot anthropomorphism is more or less advantageous for a brand and the underlying mechanisms that can inhibit its effectiveness.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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