Service Robots Rising: How Humanoid Robots Influence Service Experiences and Food Consumption

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Report Summary

Interactions between consumers and humanoid service robots (i.e., robots with a human-like morphology such as a face, arms, and legs) soon will be part of routine marketplace experiences, and represent a primary arena for innovation in services and shopper marketing. At the same time, it is not clear whether humanoid robots, relative to human employees, trigger positive or negative consequences for consumers and companies. Although creating robots that appear as much like humans as possible is the "holy grail" in robotics, there is a risk that consumers will respond negatively to highly human-like robots, due to the feelings of discomfort that such robots can evoke.

Here, Martin Mende, Maura Scott, Jenny van Doorn, Ilana Shanks, and Dhruv Grewal investigate whether humanoid service robots (HSRs) trigger discomfort and what the consequences might be for customers' service experiences. They focus on the effects of HSRs in a food consumption context.

Six experimental studies, conducted in the context of restaurant services, reveal that consumers report lower assessments of the server when their food is served by a humanoid service robot than by a human server, but their desire for food and their actual food consumption increases. Investigating the underlying process driving these effects, the authors find that humanoid service robots put consumers in a state of discomfort (e.g., eeriness), which results in greater food intake. Moreover, this research identifies boundary conditions of the effects, such that the adverse responses that humanoid service robots elicit are (1) elevated when a perceived threat to human identity is high and (2) mitigated when consumer-perceived social belongingness is high.

Managerial implications
These findings have critical implications for organizations considering the use of HSRs.

Companies that aim to employ service robots should account for consumers' technology anxiety or readiness and customize service experiences accordingly. For example, companies might assign human service providers to customers with low levels of technology readiness but offer HSRs to their technology-ready peers.

Managers should also be cognizant of the implications of forcing consumers to use technologies. They might offer consumers a choice of being served by humans or HSRs, to help offset the negative effects HSRs can trigger. A related implication is to roll out the technology slowly and take time to gauge reactions from customers.

Finally, the organizational context should define the actual implementation of HSRs. In restaurants with many nonrecurring customers, such as at airports or train stations, the use of HSR may be a viable option, while restaurants that depend on a loyal customer base may be well-advised to use caution until the long-term consequences of the use of HSRs have been further explored. Given the moderating role of social belongingness, HSRs might be a reasonable option in food settings that promote sociability.

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"I thought, why on earth are all these people taking a picture of a receptionist? I looked

at her carefully and I realized it was a robot." (Hu 2015)

Consumers' responses to Aiko Chihira, a humanoid robot working the information desk

of a Tokyo department store, often are along these lines. The robot is designed to look like a 32-

year-old woman, dressed in a silk kimono; its silicone body and smooth movements (e.g.,

bowing, blinking) frequently confuse customers (as intended by the robot's design), suggesting

to them that they are interacting with a human employee (Hu 2015). Such human–humanoid

encounters in the marketplace are not as futuristic as they might seem, and they represent a

primary arena for innovation in services and shopper marketing (van Doorn et al. 2017; Shankar

et al. 2011). Although technology already continuously influences customer service experiences

(e.g., Giebelhausen et al. 2014; Huang and Rust 2013; Meuter et al. 2005; Parasuraman and

Colby 2015), the emergence of humanoid robots is likely to be among the most dramatic

evolutions in the service realm; and it is already underway. In Asia, Pizza Hut is rolling out

humanoid robot waiters to take orders and interact with customers (Curtis 2016), and a restaurant

in China replaced its employees with human-like robot waiters, which take orders and speak to

customers in simple Mandarin phrases (Victor 2014). In the United States, Disney Corporation is

developing humanoid actors that it plans to use in customer service roles (Wattles 2017). Finally,

Softbank's humanoid robot Pepper recently worked in a restaurant at the Oakland Airport,

serving as a restaurant host and offering food and drink recommendations (Heater 2017). As

interactions between customers and humanoid robots become increasingly common, researchers

at Oxford University have predicted that some restaurant and other service professions face a 90% chance of being fully replaced by automation within two decades (Frey and Osborn 2013).

This emergence of humanoid service robots (HSRs) reflects mantras in the business press about how companies can stay competitive by engaging customers through technology. For example, Bloomberg (2017) suggests that humanoid robots allow companies to create positive buzz, because they are "easy to relate to thanks to their human-like mannerisms and emotions." However, companies that intend to use HSRs need to consider a major conundrum: Although creating robots that appear as much like humans as possible is the "holy grail" in robotics (Rubin 2003), there is a risk that consumers respond negatively to highly human-like robots, due to the feelings of discomfort (e.g., eeriness) that such robots can evoke among humans—a phenomenon conceptualized in social robotics as the "uncanny valley" (Mori, MacDorman, and Kageki 2012). Empirical support for the uncanny valley concept remains mixed (Kätsyri et al. 2015; Piwek, McKay, and Pollick 2014), and it has yet to be tested in marketing settings; therefore, the goal of this paper is to investigate whether HSRs trigger discomfort and what the consequences might be for customers' service experiences. Noting the expanding presence of HSRs in restaurants—a service setting that is common to most consumers' lives—we focus on the effects of HSRs in a food consumption context. Specifically, we examine whether customers who receive food served by an HSR (vs. a human service provider) experience greater discomfort. Moreover, we investigate whether these customers, as a consequence, eat *less* food, or whether they actually eat *more* food to offset the discomfort caused by the HSR. Finally, we examine boundary conditions of the effects that HSRs have on customers' food consumption related to (i) a perceived technology-related threat to human identity and (ii) the consumer's level of social belongingness.

By addressing these questions, this research makes three contributions to marketing literature. First, we link marketing research to the concept of the uncanny valley (Mori, MacDorman, and Kageki 2012) to explicate how HSRs influence consumer experiences. Although the idea of the uncanny valley is prominent in the field of social robotics, the empirical results regarding its conceptual predictions remain mixed (Kätsyri et al. 2015; Piwek, McKay, and Pollick 2014). Our research is among the first in marketing to test how customers respond to different HSRs. Supporting the idea of the uncanny valley, we show that HSRs (vs. human waiters) serving customers in a restaurant *decrease* customers' assessments of the service provider. In parallel, we find that interacting with HSRs *increases* consumers' desire for food and their food consumption, in terms of both anticipated and actual food intake. Demonstrating the robustness of this effect, we confirm it for three different humanoid robots and across a variety of food categories (e.g., cheese cubes, chicken sandwiches, French fries, buffet foods).

Second, our research reveals the process driving these effects. Consistent with the notion that a robot's highly human-like appearance can backfire, we find that HSRs trigger a state of unease (e.g., discomfort), which functions as a mediator, linking HSRs and customers' responses (i.e., decreased favorability toward the robot but increased food intake). We also rule out an alternative explanation for why customers increase their food consumption when being served by an HSR versus a human (i.e., reduced need for impression management in front of the robot).

Third, we identify three moderators of the adverse response to HSRs. Specifically, illustrating the process through moderation, we demonstrate the crucial role of a threat to human identity on customer responses to HSRs, such that as the perceived threat to human identity from technology increases, the food-related effect increases. Building on this finding, we then show that social belongingness, as another moderator, can help overcome effects of the threat to

human identity, such that when customers experience high levels of social belongingness, the adverse effects elicited by HSRs are alleviated.

Taken together, the six studies reported here extend theoretical insights from prior marketing research on the impact of technology on customer service experiences (e.g., Giebelhausen et al. 2014). They also offer actionable managerial implications.

CONSUMER RESPONSES TO HUMANOID SERVICE ROBOTS

Consumer Comfort or Discomfort with Humanoid Service Robots

Firms employ humanoid robots in service frontlines to evoke the perception of a conspecific presence (van Doorn et al. 2017), consistent with the notion that customers relate easily to them, due to the robots' human-like mannerisms and emotions (Bloomberg 2017). A review of literature on social robotics is beyond the scope of our discussion (see Kanda and Ishiguro 2013), but we note that robots with more human-like features appear more likely to inspire trust, be more sociable, and encourage human users to bond with them (Broadbent et al. 2008; Li, Rau, and Li 2010). Accordingly, it might seem beneficial for companies to use humanoid robots in their service frontlines.

However, an alternative theoretical lens on how people respond to human-like robots (e.g., Jacucci et al. 2014) suggests instead that synthetic agents with highly human-like attributes might elicit negative responses (Moosa and Ud-Dean 2010). Specifically, a humanoid robot that imitates but fails to attain humanness fully might trigger feelings of discomfort (e.g., eeriness), because people perceive a mismatch between the anticipated human qualities of the robot and its actually imperfect, nonhuman qualities; this experience is referred to as the uncanny valley (Mori, MacDorman, and Kageki 2012).

The various conceptual accounts for why humanoids cause a sense of eeriness in humans typically are grounded in evolutionary mechanisms and are united by the central idea that people feel threatened (Gray and Wegner 2012). For instance, MacDorman (2005) draws on terror management theory to propose that androids animated in a non-human manner elicit mortality salience; the eerie sensation associated with the uncanny valley thus might result from the violation of (typically subconscious) norms of human appearance and movement. A robot that looks like a human but deviates from those norms might be unsettling inasmuch as it elicits the idea of "the living dead" (MacDorman 2005, p. 399). Other authors point to evolutionary mechanisms related to pathogen avoidance to explain why people react to humanoids with discomfort (Moosa and Ud-Dean 2010). For example, an account drawing on face processing theory predicts that people develop a prototypical representation of what a normal human face looks like so they can distinguish healthy from sick individuals; a face that is not consistent with the focal prototype is perceived as potentially unhealthy, so it elicits discomfort (Lewkowicz and Ghazanfar 2012; Rhodes and Tremewan 1996). Finally, consistent with the idea that discomfort is an instinct that protects people from sources of danger (Mori, MacDorman, and Kageki 2012), other research posits that people associate robots with a threat to human identity related to fears of job loss, loss of control, robotic dysfunction, or even scenarios in which humanity is overthrown by intelligent robots (Ray, Mondada, and Siegwart 2008).

In summary, though empirical support for the uncanny valley remains mixed (e.g., Kätsyri et al. 2015; Piwek, McKay, and Pollick 2014), various accounts for how humans respond to humanoids suggest "an undercurrent of apprehension or unease" (Gray and Wegner 2012, p. 125). Therefore, we predict that consumers experience discomfort when they are served by humanoid robots. Furthermore, we expect that consumers, in light of this discomfort, also judge

HSRs (vs. human employees) more negatively. This spillover effect is consistent with the concept of affect-as-information, according to which people make judgments about a target object in light of the valence of their momentary feelings (e.g., they interpret unpleasant feelings as evidence of disliking) (Pham 2008). Accordingly, we hypothesize:

H₁: Consumers respond to a humanoid service robot (vs. a human service provider) with (a) increased levels of discomfort and (b) less favorable attitudes.

Consumers' Caloric Intake in Response to HSRs

Predicting that HSRs elicit discomfort raises the question of how consumers cope with this discomfort. Two insights help address this question. First, because humanoids are stressors (e.g., they might trigger perceptions of threat), they activate human defense mechanisms (MacDorman 2005). Second, people can use various defense mechanisms to respond to stressors, but "most individuals increase their food intake during stress" (Adam and Epel 2007, p. 449). The association between stress and eating is complex and influenced by various factors (e.g., gender, dieting status; Greeno and Wing 1994; Wallis and Hetherington 2004), but multiple empirical studies reveal that, in general, people respond to negative emotions with an increased motivation to eat and actual food intake (for an overview, Macht 2008). Such affect-induced eating occurs not only among restrained and emotional eaters (Wallis and Hetherington 2004) but also in field studies with healthy, normal-weight people in everyday life (e.g., Macht and Simons 2000), regardless of their gender and dieting status (e.g., Oliver and Wardle 1999).

According to emotional eating theory, negative emotions are stimuli that elicit eating as an instrumental behavior that reduces negative affect (Macht 2008). Similar explanations conceptualize stress-induced eating as a strategy to distract oneself from a focal stressor, a means to mask the source of stress (Polivy and Herman 1999), or a way to escape aversive self-

awareness (Heatherton and Baumeister 1991). Feelings of threat and distress thus are linked to

eating, because food can shift attention away from an ego-threatening stimulus (Heatherton,

Herman, and Polivy 1991; Wallis and Hetherington 2004). Drawing on these insights, we expect

that consumers respond to being served food by an HSR (vs. a human) with increased eating.

> **H2:** Consumers increase their food consumption when they are served by a humanoid service robot (vs. a human service provider).

EMPIRICAL OVERVIEW

We test our hypotheses with six studies, conducted in a variety of food-related settings

and using three distinct HSRs as stimuli. Studies 1A–C not only examine how HSRs influence

consumers' food choices but also reveal serial mediation, establishing that HSRs put consumers

in a state of discomfort, which leads to a negative attitude toward the service providers, which

consumers then cope with by increasing their caloric intake. Study 2 investigates the moderating

role of the technology-related threat to human identity on the relationship between service

provider type (human vs. HSR) and food consumption; it reveals that as the threat to human

identity from technology increases, the food-related effect increases. Studies 3A and 3B test for

the moderating effect of social belongingness, which prior literature suggests helps people cope

with identity threats. Thus, social belongingness should make consumers more resilient in their

interactions with the HSR and attenuate their increased food consumption; the analyses confirm

that high levels of social belongingness (primed in Study 3A, measured in Study 3B) mitigate the

negative effects that HSRs can elicit.

The main dependent variable in all six studies is actual eating or a desire to eat, so in all

studies, we control for hunger levels (Poor, Duhachek, and Krishnan 2013), dieting behavior

(Scott et al. 2008), gender, and age (McCrory et al. 1999)—all factors that influence food

choices. We also control for the perceived novelty of the restaurant formats, to rule out mere novelty effects related to the robots (Roehrich 2004). Together, the six studies provide convergent evidence that HSRs systematically influence consumers' service experiences, with downstream effects on their actual behaviors and actionable insights for marketing managers.

STUDY 1: EFFECTS OF HSRs VS. HUMAN SERVICE PROVIDERS ON CONSUMPTION

To examine whether interacting with HSRs (vs. human providers) influences customer discomfort (H_{1a}), attitudes (H_{1b}), and food choices (H_2), Studies 1A–C each employed a one-way between-subjects design, with two service provider levels (HSR vs. human). For the actual food consumption in Study 1A, participants watched a video of an HSR or a human service provider describing how the food was prepared, and then they consumed the food. In Study 1B, we filmed a second set of videos with an actual robot or human service provider in an actual restaurant with an all-you-can-eat format to examine our hypotheses. Finally, to generalize these findings, Study 1C features another HSR, which was designed to appear identical to its human counterpart.

Study 1A: Video-Based Encounter with a Robot (vs. Human) with Actual Food Consumption

Study 1A features a one-way, between-subjects design, with two service provider levels (HSR vs. human). The 215 student participants received course credit (M_{Age} = 21 years, 114 women). We examined *actual eating behavior* by inviting participants to a cheese taste test. They sat at individual computer stations, each with a box containing 20 uniformly cut cubes of Gouda cheese. Before they started eating, participants indicated their hunger level ("How hungry are you at this moment?" 1 = "not at all," 7 = "very much").

We manipulated employee type by informing participants that they would taste a new type of cheese prepared in a test kitchen and that "This cheese was prepared and sliced for you by this employee of our test kitchen as you can see in the video below." Respondents then watched a video with either a humanoid robot or a human behind a table with a cutting board and cheese cubes, holding a knife (see Appendix, Panel A). In the video, the service provider said "Hello. Welcome to the test kitchen. This is cheese I prepared for you today. Please try a sample. You are welcome to eat as much of it as you would like." After seeing this video, participants started eating and could eat as much cheese as they wanted while watching a brief history video (unrelated to cheese or technology) and answering questions. The main dependent variable was the number of cheese cubes eaten; after participants left the lab, an assistant, blind to our hypotheses, documented the number of cheese pieces eaten by each participant.

Participants indicated their attitude toward the service provider ("dislike/like," "bad/good," "negative/positive," "unfavorable/favorable," bipolar, seven-point scales). We also asked participants to indicate their level of discomfort with the employee ("This kitchen staff member is creepy/eerie/unnatural," 1 = "not at all," 7 = "very much so").

Study 1A also tests an alternative explanation for why consumers might increase their caloric intake when served by an HSR relative to a human service provider. Consumers might feel embarrassed when they eat or order food in front of other people (Herman, Roth, and Polivy 2003; Hetherington et al. 2006; Polivy et al. 1986) (i.e., customers' increased consumption could be driven by the absence of embarrassment when they are served by an HSR). To test this impression management explanation, we also asked participants to indicate the extent to which eating the cheese made them feel embarrassed ("Eating this cheese makes me feel not at all embarrassed/very embarrassed, not at all uncomfortable/very uncomfortable, not at all

awkward/very awkward, not at all self-conscious/very self-conscious," adapted from Dahl,

Manchanda, and Argo 2001; bipolar, seven-point scales).

As a manipulation check, we used agreement measures to determine the extent to which

the employee seemed robotic ("The kitchen staff member is like a person [R]/machine-like"). In

this and all studies, we controlled for hunger, demographic data (age, gender, dieting status), and

the novelty of the experience. Because the data collection sessions took place over multiple days,

we also controlled for the time of day (Boland, Connell and Vallen 2013). Five participants were

removed from the analysis: three respondents who participated twice and two respondents who

did not eat any cheese, due to health reasons.

Results

Manipulation check. The analysis of variance (ANOVA) for the manipulation check

index revealed a main effect of service provider type ($M_{HSR} = 5.74$, $M_{Human} = 2.26$; $F(1, 208) =$

577.49, $p < .001$). That is, the manipulation performed as intended.

Discomfort with the service provider. In support of H_{1a}, an analysis of covariance

(ANCOVA) on discomfort with the service provider ($\alpha = .76$) revealed that consumers felt

greater discomfort when told that the cheese was prepared by the HSR rather than the human

service provider ($M_{HSR} = 3.69$, $M_{Human} = 2.33$; $F(1, 196) = 67.67$, $p < .001$).[1]

Attitude toward the service provider. The ANCOVA for the attitude index ($\alpha = .94$)

further revealed that consumers were less favorable toward the HSR than toward the human

service provider ($M_{HSR} = 5.03$, $M_{Human} = 5.45$; $F(1, 196) = 7.34$, $p < .01$), consistent with H_{1b}.

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[1] As noted, we controlled for age, gender, hunger, dieting, novelty, and time of the day. In all subsequent analyses, we discuss the covariate results only if they are significant. In Study 1A, for discomfort, gender and time of day were significant ($ps < .05$), and for quantity consumed, gender, hunger, and time of day were significant ($ps < .05$).

Quantity consumed. We conducted an ANCOVA for the number of cheese cubes eaten as a function of service provider type. Participants ate more when the cheese was prepared by an HSR rather than a human service provider ($M_{HSR} = 7.35$, $M_{Human} = 5.99$; $F(1, 196) = 4.03$, $p < .05$), in support of H_2.

Mediation analysis. We conducted a serial mediation analysis (Hayes 2015; Process Model 6) to test our theorizing that when food is prepared by an HSR (vs. human), consumers feel relatively more uncomfortable, which leads to a less favorable attitude, which triggers increased food consumption. In the model, the independent variable was server type (human = 0, HSR = 1), M1 was discomfort toward the service provider, M2 was attitude toward the service provider, and the dependent variable was the number of cheese cubes consumed. As in the main analysis, the covariates were age, gender, hunger, dieting, novelty, and time of the day. We uncovered a mediational path consistent with our theorizing (HSR → increased discomfort → decreased favorability toward the service provider → increased food consumption) ($a \times b = -.19$; 95% confidence interval [CI]: -.50, -.04).

Embarrassment as an alternative explanation. The ANCOVA for the embarrassment index ($\alpha = .78$) revealed no effects of embarrassment ($F(1, 196) = .03$, $p = .87$). We thus rule out embarrassment as an alternative explanation for the increase in food consumption.

Study 1B: Video-Based Encounter with a Different Robot Filmed in a Restaurant

With this study, we seek to replicate the findings from Study 1A and generalize the effects to a different HSR. The participants were 123 online MTurk participants in the United States who participated in exchange for payment ($M_{Age} = 37.34$ years, 57 women).

We filmed an actual robot (or person) in an actual restaurant; this video served as the stimulus for the study. We asked study participants to imagine going to dinner at a new all-you-can-eat restaurant, then manipulated the service provider by asking participants to watch a video that showed either an HSR or a human employee as the greeter in the restaurant. In the video, the HSR or human said, "Hello and welcome. Would you like a table or a booth? Please have a seat and look at the menu. Your server will be right over."

The main dependent variable was the caloric content of the selected meal. The description of the restaurant format noted that patrons could indicate the amount of each food item they desired (sliding scale, 0–100% of a serving for each; one serving of each entrée item was described as 5 ounces, and one serving of each side item was described as 3 ounces). Participants considered six entrée items (grilled chicken breast, broiled salmon, grilled steak, lasagna, bacon cheeseburger, chicken tenders; in random order) and six side items (side salad, grilled asparagus, steamed broccoli, French fries, baked macaroni and cheese, mozzarella sticks; in random order), and they could have as much or as little of each item as they would like. The software showed the participant the exact amount of each item selected. We calculated the caloric content of the food using the website www.CalorieCount.com.

This test also included the same manipulation check items as in Study 1A and the controls for hunger, demographic data (age, gender, dieting status), and the novelty of the service experience. Six participants were removed from the analysis (two encountered technical difficulties with the video, and four indicated dietary restrictions related to the listed food).

Results

    Manipulation check. The ANOVA for the manipulation check index revealed a main effect of service provider type (M_{HSR} = 6.07, M_{Human} = 2.30; F(1, 115) = 279.72, $p < .001$). Thus, the manipulation performed as intended.

    Discomfort with the service provider. In support of H_{1a}, the ANCOVA for discomfort (α = .93) revealed that consumers felt greater eeriness when interacting with the HSR relative to the human service provider (M_{HSR} = 4.35, M_{Human} = 2.14; $F(1, 110) = 34.59$, $p < .001$).

    Attitude toward the service provider. The ANCOVA for the attitude index (α = .98) also showed that consumers were less favorable toward the HSR than toward the human service provider (M_{HSR} = 4.47, M_{Human} = 5.25; $F(1, 110) = 3.99$, $p < .05$), in further support of H_{1b}.

    Consumption intentions. The ANCOVA for the total calories selected as a function of service provider type indicated that participants selected more calories after watching the video with the HSR than with a human service provider (M_{HSR} = 1265.95, M_{Human} = 938.02; $F(1, 110) = 4.36$, $p < .05$), in support of H_2.[2]

    Mediation analysis. Again, we conducted a serial mediation analysis (Hayes 2015; Process Model 6). The independent variable was provider type (human = 0, HSR = 1), M1 was discomfort toward the provider, M2 was attitude toward the provider, and the dependent variable was calories selected. As in the main analysis, the covariates were age, gender, hunger, dieting, and service novelty. The results affirmed the corresponding mediational path (HSR → increased discomfort toward the server → decreased favorability toward the server → increased calories selected) (a × b = –83.32; 95% CI: –254.64, –4.14).

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[2] For discomfort, novelty was a significant control variable ($p < .05$). For caloric content, novelty, dieting, and gender were significant control variables (ps $< .05$).

Study 1C: Replication and Ruling Out Appearance Differences

Building on these findings, in Study 1C we adopt an HSR designed to look like its human counterpart, which can help us rule out the appearance differences that were present in the previous studies as a cause of the results (see Appendix, Panel C). The focal HSR already has worked as a service employee in real-world settings (e.g., receptionist and guide in a Tokyo museum) (Demetriou 2014). The participants were 128 students who participated in exchange for course credit (M_{Age} = 20.70 years, 68 women). We asked them to imagine going to dinner at a new all-you-can-eat restaurant. We manipulated the server by presenting pictures of either a human or a humanoid server and describing her as either a woman or a humanoid robot.

The main dependent variable was the caloric intake selected. The restaurant format was described in a manner similar and using the same 12 foods as in Study 1B. Participants had the option of selecting between no and two servings of each food item. After making their food choices, participants indicated their attitude and discomfort toward the service provider and answered the manipulation check, using the same items as in Studies 1A and 1B. Finally, they indicated their hunger, demographic data (age, gender, dieting), and perceived service novelty. Eleven participants were removed due to dietary restrictions related to the focal foods.

Results.

Manipulation check. The ANOVA of the manipulation check index revealed a main effect of service provider type (M_{HSR} = 5.22, M_{Human} = 2.98; $F(1, 115)$ = 77.41, $p < .001$). That is, the manipulation performed as intended.

Discomfort with the service provider. In support of H$_{1a}$, an ANCOVA for discomfort (α = .94) revealed that consumers felt greater eeriness when interacting with the HSR relative to the

human service provider (M_{HSR} = 5.33, M_{Human} = 2.94; F(1, 110) = 75.35, p < .001).

Attitude toward the service provider. The ANCOVA for the attitude index (α = .97) showed that consumers were less favorable toward the HSR than toward the human server (M_{HSR} = 4.11, M_{Human} = 5.13; F(1, 110) = 10.61, p < .001), again supporting H_{1b}.

Consumption intentions. An ANCOVA for the calories selected from the menu indicates that consumers selected more calories when served by an HSR relative to the human (M_{HSR} = 1736.30, M_{Human} = 1397.58; F(1, 110) = 4.78, p < .05), in support of H_2.[3]

Mediation analysis. We conducted a serial mediation analysis (Hayes 2015; Process Model 6), and in the model, the independent variable was provider type (human = 0, HSR = 1), M1 was discomfort, M2 was attitude, and the dependent variable was calories selected. Covariates were age, gender, hunger, dieting, and restaurant novelty. These results revealed the corresponding mediational path (HSR → increased discomfort toward the server → decreased favorability toward the server → increased calories selected) at the 95% confidence interval (CI) (a × b = –127.06; 95% CI [–308.04, –2.81]).

Discussion Studies 1A-C

In support of H_1 and H_2, Studies 1A–C provide convergent evidence that consumers respond systematically differently to an HSR than to a human service provider. Specifically, exposure to a humanoid robot (vs. human) service provider results in greater feelings of discomfort, which trigger negative attitudes, leading customers to choose meals with greater caloric content (Studies 1B, 1C) and actually eat more food (Study 1A). Beyond revealing this interesting customer response (attitude toward the service provider *decreases*, but food consumption *increases*), Study 1 also sheds light on the underlying process and the chain of

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[3] For discomfort, novelty was a significant covariate (p < .05). For caloric content, gender was significant (p < .01).

effects that links HSRs and consumers' food choices—while also ruling out embarrassment as an alternative explanation for the increase in food consumption. Our theorized effects thus emerge for three different HSRs, presented in videos and pictures in different surroundings, and across multiple types of food.

Our findings are consistent with research that has shown how technology can elicit discomfort in consumers (e.g., Giebelhausen et al. 2014; Parasuraman and Colby 2015); for example, Mick and Fournier (1998) found that technology used in consumers' daily lives can evoke anxiety and stress (e.g., cautiousness, frustration), and Meuter et al. (2003) observed that consumers can experience anxiety toward self-service technologies. However, we theorize that our findings are related to a qualitatively distinct phenomenon: HSRs might be eliciting eeriness when consumers perceive the technology to be a threat to their human identity. Accordingly, we expect to observe the greater adverse responses to an HSR among those consumers who report elevated levels of technology-related threat to human identity. Study 2 examines this prediction.

STUDY 2: THE ROLE OF THREAT TO HUMAN IDENTITY

Study 2 seeks to replicate the basic effect of being served by an HSR on customers' food consumption intentions. In addition, we investigate whether an increase in the amount of human identity threat experienced due to the presence of an HSR also increases the intended consumption and feelings of discomfort.

Design, Procedure, and Participants

Members from Amazon's MTurk (N = 110; M_{Age} = 34.48; 57 women) were randomly assigned to watch the video from Study 1B of either a human or robot service provider. After watching the video, they saw a picture of a chicken sandwich with French fries and indicated the

percentage of each food they would eat. Our dependent variable was the caloric content of the chicken sandwich and French fries that participants indicated they would eat. We calculated the calorie content of the food selected using the website http://caloriecontrol.org/healthy-weight-tool-kit/food-calorie-calculator. Participants also indicated their level of discomfort with the service provider ("A meal being prepared by this service provider would be comforting [R]/creepy/eerie/unnatural," 1 = "strongly disagree," 7 = "strongly agree").

We measured the extent to which participants felt a threat to their human identity ("It is important to me to show that I am not machine like," "In general, I am glad that I am human," "Machines will increasingly take jobs away from humans," and "It concerns me when jobs are outsourced to machines"; 1 = "strongly disagree," 7 = "strongly agree"; derived from Simon and Ruhs 2008; Zlotowski, Yogeeswaran, and Bartneck 2017). The study included the same manipulation checks and control variables as in Study 1.

Results

Manipulation check. The ANOVA for the manipulation check showed that participants viewed the HSR as significantly more robotic than the human provider ($M_{Human} = 2.67$, $M_{HSR} = 5.84$; $F(1, 108) = 165.48$, $p < .001$). Thus, our manipulation performed as intended.

Consumption intentions. We conducted a provider type by human identity threat ANCOVA on consumption intentions, controlling for hunger, dieting, age, gender, and novelty. It revealed the predicted two-way interaction of service provider type and human identity-related threat ($F(1, 101) = 7.07$, $p = .009$), as we show in Figure 1, Panel A. The service provider type

main effect was significant ($F(1, 101) = 4.26$, $p = .04$); the human identity threat main effect was non-significant ($p = .63$).[4]

We conducted a floodlight analysis using the Johnson-Neyman procedure (Spiller et al. 2013) to examine the significant two-way interaction. The floodlight analysis revealed that when human identity threat was greater than or equal to 5.10 (i.e., Johnson-Neyman point), participants intended to increase their amount of calorie consumption significantly more when served by an HSR than when served by a human service provider (Figure 1, Panel A).

(Figure 1 follows References.)

Discomfort with the service provider. For the ANCOVA for the discomfort index (α = .93), we found a significant two-way interaction ($F(1, 101) = 4.84$, $p < .05$; see Figure 1, Panel B). The main effect of human identity threat was significant ($F(1, 101) = 12.80$, $p = .001$). The main effect of service provider type was not significant ($F(1, 101) = 1.37$, $p = .25$). A floodlight analysis using the Johnson-Neyman procedure (Spiller et al. 2013) showed that when human identity threat was greater than or equal to 4.25, participants felt significantly more discomfort when served by an HSR than by a human service provider (Figure 1, Panel B).

Test of moderated mediation. We conducted a moderated mediation analysis (PROCESS Model 58, 5000 resamples; Hayes 2015), which shows that discomfort mediates the effect of the interaction between human identity threat and service provider type on intended calorie consumption (a $\times$ b = 29.84; 95% CI = 8.21, 67.89). Specifically, when the service provider was an HSR, the indirect effect for human identity threat on the amount of intended calories

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[4] In the ANCOVA model for consumption, gender was a marginally significant covariate ($F(1, 101) = 3.35$, $p = .07$); in the ANCOVA model for discomfort, novelty was a marginally significant covariate ($F(1, 101) = 3.68$, $p = .06$).

consumed was significantly mediated by discomfort (a × b = 26.67; 95% CI: 7.63, 59.69). There was no mediation effect when the provider was a human (a × b = -3.17; 95% CI: -24.40, 3.27).

Discussion

These results suggest that consumers respond differently to an HSR than to human service providers, replicating the basic effect demonstrated in Study 1: When consumers are served by an HSR, they intend to consume more calories. Furthermore, Study 2 demonstrates that the level of threat to human identity a consumer experiences influences this relationship. When served by an HSR (vs. human), consumers who experience a higher threat to their human identity express significantly greater consumption intentions with an HSR (vs. human); but this effect is reduced among consumers who sense a low threat to their human identity. Similar effects emerge for the amount of discomfort a consumer experiences. Participants who experience high levels of human identity threat also feel greater discomfort with an HSR (vs. human) service provider, but this effect is reduced among people with low levels of human identity threat. Finally, the results suggest that discomfort mediates the relationship of service provider type with human identity threat and increased calorie consumption. Based on understanding HSRs as a potential identity threat, we now examine social belongingness as a way to cope with this threat.

MODERATING ROLE OF SOCIAL BELONGINGNESS

As demonstrated, HSRs elicit feelings of discomfort (Studies 1A–C) and can be perceived as threats to human identity (Study 2; Gray and Wegner 2012; Mori, MacDorman, and Kageki 2012). Threats to the psychological self motivate efforts to cope (Twenge et al. 2007). How people react to threats depends on many factors (beyond the scope of our research), but one

effective way to buffer the impact of a stressor is to affirm the self (Shnabel et al. 2013). Self-affirmation—the process by which people reinforce their self-integrity and image as effective and able—increases psychological resources for coping with a threat (Cohen and Garcia 2008). Self-affirmation theory specifies three elements to explain this effect: Self-affirmation boosts personal resources to cope with a threat (e.g., less ego depletion), which broadens the person's perspective on the threat (e.g., by shifting construal levels), so it becomes less psychologically dire, which leads the person "to acknowledge the threat without negative effects on psychological well-being" (Shnabel et al. 2013, p. 664).

Recent theoretical advances suggest that *social belongingness* (i.e., feeling more connected to other people) is a crucial ingredient for self-affirmation in the face of an identity-related threat. Reflecting on social belonging can affirm the self, "because fitting into social groups is an important aspect of human adequacy" (Shnabel et al. 2013, p. 672). For example, reminding people of familial bonds helps them tolerate threats in another domain (e.g., doing poorly in school; Cohen et al. 2006). Similarly, social belongingness can offer a defense to self-threats related to social exclusion, which suggests that social belongingness offers a remedy for people in distress (DeWall, Baumeister, and Vohs 2008; Twenge et al. 2007).

In short, reminding themselves of their meaningful social connections with others bolsters people's self-integrity, which in turn makes them more resilient in situations that otherwise may seem dire (Shnabel et al. 2013). Therefore, we predict that if the identity-related threat of an HSR drives the increase in consumption, social belonging attenuates this outcome. Affirming a consumer's sense of social belongingness then may be an alternative means to face the threat elicited by an HSR, which should mitigate the need to cope by consuming more food.

> **H₃:** Social belongingness mitigates the increase in caloric intake that consumers display in response to a humanoid service robot.

In Study 3A, we *manipulate* consumers' perceived levels of social belongingness; in Study 3B, we *measure* social belongingness in an actual consumption setting. Specifically, in Study 3A, we expect that consumers who are primed to feel less connected to others will have a greater desire to consume food when interacting with an HSR, but this effect will be attenuated for consumers who are primed to feel more connected to others. In Study 3B, we measure consumers' sense of social belongingness and anticipate that higher levels attenuate the corresponding effects on consumption.

Study 3A: Priming Social Belongingness

Participants and procedure. Participants were 148 students in the United States ($M_{Age} = $ 20.33 years; 60 women) who participated in exchange for course credit. The study employed a 2 (HSR, human) $\times$ 2 (social belongingness, control) between-subjects design. We conducted it, ostensibly, in two unrelated parts.

First, we manipulated social belongingness, according to a procedure by DeWall, Baumeister, and Vohs (2008). Participants in the social belonging condition read that some survey questions they had completed several weeks before (as part of a subject pool enrollment survey) indicated that their "personality type is one in which you can anticipate positive and lasting relationships throughout life." Next, we asked the participants to describe, in several sentences, a time they felt socially connected to another person or a group. Participants in the control condition did not complete this portion of the study.

Second, we manipulated provider type as in Study 1C (Appendix, Panel C). Participants read a scenario about going to a restaurant and ordering a chicken salad meal. We provided a picture of the dish, along with the picture of one of the two randomly assigned service providers

(HSR vs. human). The dependent variable was the desirability and anticipated taste of the food ("looks appetizing", "will taste good," "looks nice," "has a pleasant texture"; 1 = "strongly disagree," 7 = "strongly agree") as a measure of the desire to consume the food.[5] Finally, we asked participants to complete the manipulation check and control variables, as in prior studies. Five vegetarian participants were removed from analysis, because the dish contained chicken.

Results

Manipulation check. The ANOVA for the manipulation check index revealed a main effect of service provider type ($M_{Human} = 2.65$, $M_{HSR} = 5.54$; $F(1, 139) = 127.77$, $p < .001$); the other effects were non-significant ($p > .43$). Thus the manipulation performed as intended.

Desirability of food. We conducted an ANCOVA on the desirability of food as a function of social belongingness, server type, and their interaction, again controlling for age, gender, hunger, dieting, and novelty. This analysis ($\alpha = .95$) revealed the expected social belongingness × server interaction ($F(1, 134) = 5.95$, $p < .05$), as depicted in Figure 2. It also revealed a marginal social belonging main effect ($F(1, 134) = 2.82$, $p < .1$); the server type main effect was non-significant ($F < 1$).

(Figure 2 follows References.)

Contrasts revealed that when the service provider was a humanoid robot, the desirability of food decreased if we primed social belonging ($M_{Control} = 5.84$, $M_{Belong} = 4.78$, $F(1, 134) = 8.11$, $p < .005$). However, when the service provider was human, desire for food was unaffected by social belonging ($M_{Control} = 4.98$, $M_{Belong} = 5.16$, $F < 1$). That is, in the control condition, participants found the food *more* desirable when it was served by an HSR rather than a human

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[5] Our focus on anticipated food taste and desirability is consistent with prior research showing that people, in response to negative affect, rate food more favorably (e.g., Hepworth et al. 2010; Wagner et al. 2012).

($M_{HSR} = 5.84$, $M_{Human} = 4.98$, $F(1, 134) = 4.25$, $p < .05$). We thus replicated our findings, consistent with H$_2$, but find that this effect was attenuated when social belongingness was primed ($M_{HSR} = 4.78$, $M_{Human} = 5.16$, $F < 1$), consistent with H$_3$.

Study 3B: Measuring Social Belongingness and Actual Eating Behavior

  Participants and procedure.

  Study 3B employed a between-subjects design in which the provider type varied, and we measured social belongingness as a continuous factor. Participants were 253 students who participated in exchange for course credit ($M_{Age} = 22.05$ years, 135 women). To examine actual eating behavior, we invited participants to a taste test, similar to the one in Study 1A, in which they sat at individual computer stations, each with a box containing 20 cubes of Gouda cheese.

  We measured participants' perceived level of social belongingness ("Even around people I know, I don't feel that I really belong" [R], 1 = "strongly disagree," 7 = "strongly agree"), embedded with other questions, then manipulated the server type by informing participants that they would taste a new type of cheese that "was prepared and sliced for you by the [humanoid robot/woman] pictured below," together with the corresponding photo (Appendix, Panel C). As in Study 1A, participants could eat as much as they wanted while they watched a brief, unrelated video, and an assistant who was blind to our hypotheses documented the number of cheese pieces eaten after each participant left. Thirty-three participants were removed after they failed an attention check ("Select strongly agree"), and six vegan participants were removed (their inclusion did not change the overall pattern of the results).

Results

Manipulation check. The ANOVA for the two-item manipulation check index revealed a main effect of employee type (M_{Human} = 3.01, M_{HSR} = 4.70; $F(1, 212)$ = 74.12, p < .001). Thus, the manipulation performed as intended.

Consumption quantity. For the ANCOVA on consumption amount, we used social belongingness, service provider type, and their interaction. As in prior studies, we controlled for age, gender, hunger, dieting, and service novelty. To obtain a sufficiently large consumption sample, this study took place over a wide time window, so we also controlled for the time of day (Boland, Connell and Vallen 2013). The ANCOVA of the amount of cheese eaten revealed the predicted server type main effect ($F(1, 204)$ = 3.80, p = .05), qualified by a significant server type × social belongingness interaction ($F(1, 204)$ = 3.89, p < .05; Figure 3).[6]

(Figure 3 follows References.)

To explain the significant two-way interaction, we conducted a spotlight analysis at ±1 SD from the mean. As we predicted in H_3, when the cheese was prepared by an HSR, consumers with lower social belonging scores (–1 SD) consumed more cheese than those with higher social belonging scores (+1 SD) ($M_{LowBelong}$ = 7.64, $M_{HighBelong}$ = 5.79, t = –2.06, p < .05). When the cheese was prepared by a human, there was no difference in cheese consumption ($M_{LowBelong}$ = 6.24, $M_{HighBelong}$ = 6.92, t = .74, p = .46).

Discussion

In line with H_3, Studies 3A and 3B demonstrate that social belongingness mitigates the downstream effects of HSRs in a food context. Notably, in Study 3A, consumers who were primed with social belongingness did not need to use food as a coping mechanism; accordingly,

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[6] Gender, hunger, and time of day were significant control variables (p < .05).

they did not perceive the food as more desirable (vs. consumers in the control group). Study 3B examined *actual* food consumption, enhancing the external validity of our findings. Consumers who self-reported low social belongingness actually ate more cheese prepared by an HSR (vs. human service provider). In contrast, consumers who felt more socially connected could buffer the consumption effects triggered by the humanoid robot. In short, when served by an HSR, consumers turn to food, but social belongingness can buffer this effect.

GENERAL DISCUSSION

This manuscript examines how interacting with HSRs influences customer experiences. Our work was inspired by two main insights. First, the global market for service robots is estimated to become a billion-dollar business before 2020 (*Business Insider* 2015), so service robots will soon be the new normal in conventional service settings such as restaurants (Frey and Osborn 2013). Second, building robots with humanoid appearances and abilities is considered the 'holy grail' in robotics (Diller 2011), suggesting that designers assume human likenesses encourage humans' adoption of robots. Against this background, our research offers new theoretical and managerial implications and points to rich avenues for further research.

Theoretical Insights

Humanoid service robots elicit a new form of discomfort. Ours is not the first research to examine technology-related consumer discomfort (e.g., Giebelhausen et al. 2014; Meuter et al. 2003; Mick and Fournier 1998). Our work is generally in line with this prior research, but it also expands the analytical focus by introducing a novel, qualitatively distinct phenomenon. That is, HSRs can elicit eeriness and threats to human identity, with negative effects on consumers' attitudes toward the robots. Incorporating this new form of technology-related discomfort into

marketing theory is important, because popular media suggest that technology anxiety is rising (Doughty 2015) and that people feel increasingly threatened by robots (e.g., fears of mass unemployment; Jezard 2016; Winship 2013).

Consumers respond to HSRs with increased caloric intake. Consistent with prior research (Mick and Fournier 1998), we find that technology-derived stress prompts coping attempts. Across six studies, we show that consumers served by different HSRs cope by increasing their caloric intake (both consumption intentions and actual eating behaviors). We rule out an alternative explanation related to impression management (Study 1A) and establish that the increase in caloric intake is not driven by the absence of embarrassment when interacting with an HSR (vs. a human employee). This intriguing effect is worthy of further reflection. On the one hand, nearly 70% of U.S. consumers are overweight or obese, and obesity is linked to a plethora of illnesses and even premature death (Centers for Disease Control and Prevention 2014). Many efforts have been implemented to help reduce people's food consumption and nudge them to make healthier food choices. For example, regulations require many restaurants to include nutrition and calorie information on their menus, to help consumers make healthier choices and reduce their calorie consumption (e.g., Kozup, Creyer, and Burton 2003). Using HSRs in food settings might sabotage such efforts though, by nudging consumers to order and eat more. In this sense, our findings represent a concern from a consumer well-being perspective.

On the other hand, a focus on the linkage between customer experiences and a firm's financial performance (e.g., Mittal, Anderson, Sayrak, and Tadikamalla 2005), a pragmatic interpretation of our results must acknowledge that it benefits businesses (e.g., restaurants) when customers order more food. Still, this justification might not hold, for at least two reasons. First, while ordering more food, consumers also report less favorable attitudes toward the HSR, so

their increased consumption might go hand-in-hand with adverse downstream effects on customer loyalty; although this aspect is beyond the scope of our present research, it deserves further scholarly attention. Second, Study 1B involved an all-you-can-eat restaurant context, for which the financial benefits are greater when customers eat less, rather than more, food. Therefore, even from a purely economic perspective, our finding that HSRs trigger increased caloric intake might not be unequivocally desirable.

Contextual cues influence how consumers respond to HSRs. Because it is increasingly crucial for firms to deliver positive customer experiences (Lemon and Verhoef 2016), both marketing scholars and managers need to understand the circumstances in which consumers are most vulnerable to an adverse experience with HSRs. In this regard, we show that the core effect (HSRs elicit increased caloric intake) is linked to social belongingness (Study 3). With regard to the moderating role of social belongingness, we note that restaurants are typically social places; people frequently consume food with others (e.g., friends, family). The social setting that characterizes many restaurants thus might help prevent the detrimental effects that HSRs otherwise would trigger. As marketers venture into the realm of service robots, it is crucial to account for the contexts in which HSRs are being used.

Managerial Relevance and Implications

For organizations considering the use of HSRs, our findings have critical implications in terms of measuring consumer profiles, segmenting customers, and designing corresponding service experiences. First, companies that aim to employ service robots need to account for consumers' technology anxiety (Meuter et al. 2003) or its flipside, technology readiness (Parasuraman and Colby 2015). If corresponding measures are not available, firms could draw initial conclusions from the general correlation of technophobia with certain demographics (e.g.,

age, gender, education; Gilbert, Lee-Kelley, and Barton 2003). Second, once managers segment consumers on the basis of their technology readiness, they should customize service experiences accordingly. Current technology (e.g., customer databases) can provide a platform for such customization (Jayachandran, Sharma, Kaufman, and Raman 2005). For example, using data about consumers' technology readiness, companies might assign human service providers to customers with low levels of technology readiness but offer HSRs to their technology-ready peers. Similarly, customers who demographically appear more likely to fall into technophobe (vs. technophile) segments can be served accordingly.

Third, managers should be cognizant of the implications of forcing consumers to use technologies. Reinders, Dabholkar, and Frambach (2008) show that forcing consumers to use SST elicits negative attitudes and behavioral intentions toward the SST and the company. Managers thus might want to offer consumers a choice of being served by humans or HSRs, to help offset the negative effects HSRs can trigger. A related implication is to roll out the technology slowly and take time to gauge reactions from customers.

Fourth, the organizational context should define the actual implementation of HSRs. Using HSRs in all-you-can-eat restaurants might not be beneficial, because they likely increase customers' food consumption. For managers of conventional restaurants, the use of HSRs may be a tempting option to increase sales, however the risk of displacing human service staff from their employment prospects must be carefully considered. Potential overeating due to being served by a HSR also may negatively affect consumer well-being, in particular in the light of the current obesity crisis. And, the negative effect on consumer attitudes also cautions against the widespread use of HSRs in all restaurants. In restaurants with many nonrecurring customers, such as at airports or train stations, the use of HSR may be a viable option, while restaurants that

depend on a loyal customer base may be well-advised to use caution until the long-term consequences of the use of HSRs have been further explored.

However, considering the moderating role of social belongingness, HSRs might be a reasonable option in food settings that promote sociability (e.g., receptions, parties, happy hours, sports bars). Our research does not speak directly to other contextual aspects, but the nature of the restaurant (e.g., fast-food drive-through vs. sit-down, fine-dining experience) seems likely to influence how customers respond, too.

Limitations and Further Research

Some limitations of our work point to avenues for further research. First, scenarios in laboratory experiments with students are well-established, but more work should investigate actual interactions between customers and HSRs. Although we used videos with actual robots as stimuli in some of our studies, a major challenge is gaining access to actual HSRs; this barrier is likely to fall as more robots enter the marketplace. In parallel, we believe that using students arguably offers a conservative test of our theorizing, because students, due to their age and familiarity with technology (e.g., Laguna and Babcock 1997), if anything should be *less* likely to experience our proposed effects relative to samples of older consumers. Second, we find consistent effects across six studies, but we cannot speak to spillover effects to the brand (e.g., repurchase, word-of-mouth intentions). Consumer inferences about frontline staff have consequences for the organization (Matta and Folkes 2005), but this effect might be moderated by brand personality and positioning (Aaker 1997). Third, we focus on initial (first-time) customer–robot encounters. To advance our findings, continued research could examine habituation and whether consumers' discomfort decreases as they interact with HSRs (or the same HSR) over time. Fascinating related questions thus emerge: Which customers are more or

less loyal to HSRs than to human providers? Why? When do customers adapt to the presence of HSRs, and how? Fourth, the assessment of threat to human identity via a self-report scale could have influenced the outcomes; future research may supplement self-report measures with other approaches such as reaction-time data (Branscombe et al. 1999).

Finally, we used stimuli that depicted state-of-the-art humanoids. Further research needs to explore more specific design-related aspects and effects. Research questions should focus not just on whether to give service robots a human-like appearance but which particular features to assign to them. For example, people perceive a short-haired, male robot as more agentic than a long-haired, female robot, but they see the female robot as more communal, and these appearance-based inferences extend to the robot's task, because people believe stereotypically male tasks are a better fit for male than for female robots, and vice versa (Eyssel and Hegel 2012). Such insights relate to findings on gender stereotypes in service roles (Matta and Folkes 2005), and they also raise novel questions for the design of service-providing robots. Should service robots have a unisex appearance? Could an ability to alter their apparent gender, age, nationality, or racial features in response to the customer or task be beneficial? Thought-provoking questions like these provide marketing scholars with opportunities to conduct important research that can help guide the rise of service robots.

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FIGURE 1: CONSUMPTION INTENTIONS AND DISCOMFORT AS A FUNCTION OF
SERVICE PROVIDER TYPE AND PERCEIVED THREAT TO HUMAN IDENTITY

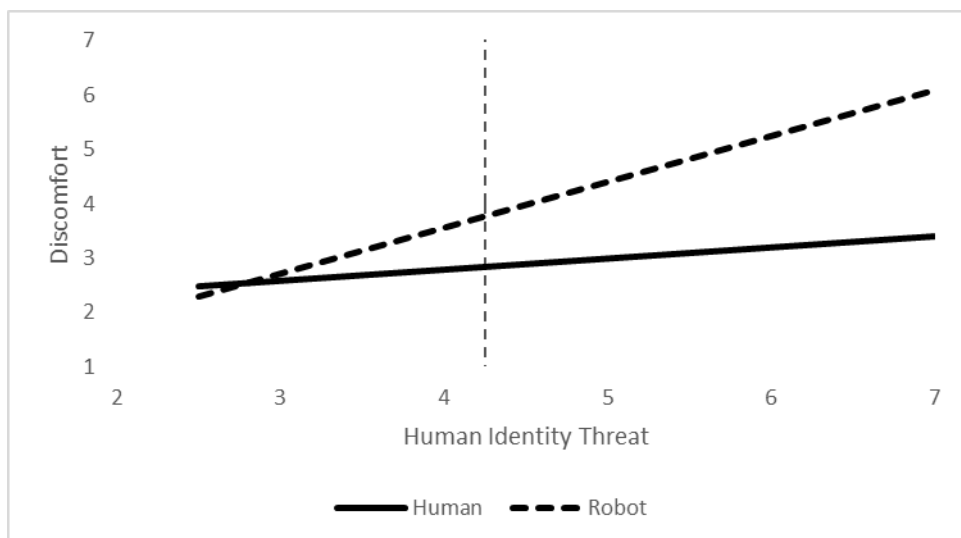Panel A: Consumption Intentions
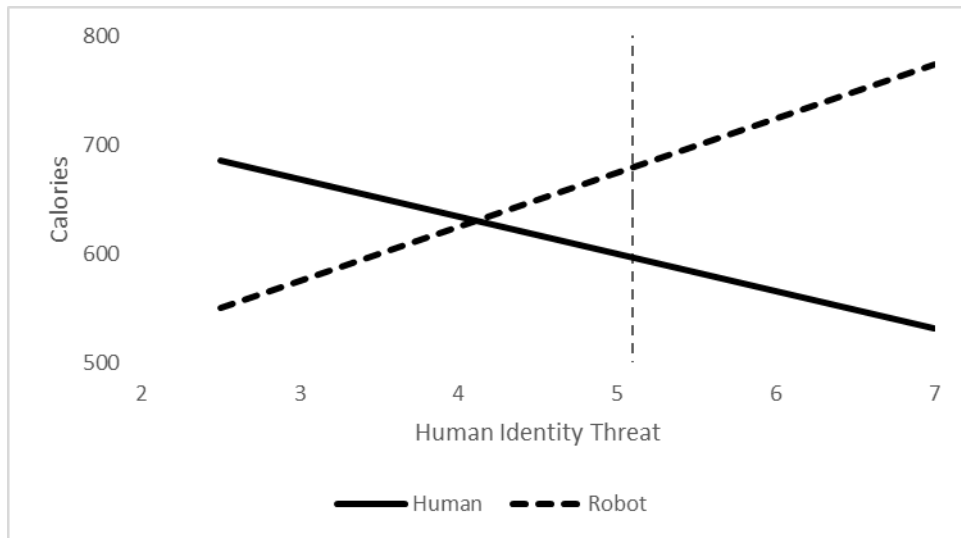
Panel B: Discomfort

FIGURE 2: EFFECTS OF PRIMED SOCIAL BELONGINGNESS AND SERVICE TYPE ON DESIRABILITY OF FOOD (STUDY 3A)
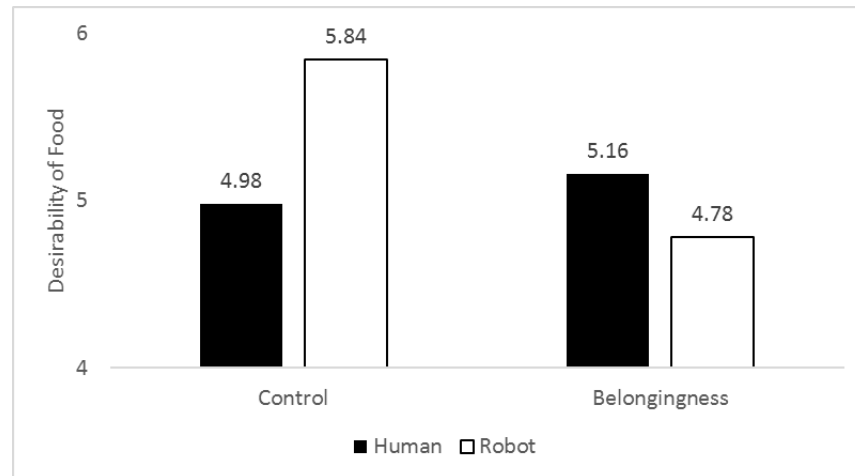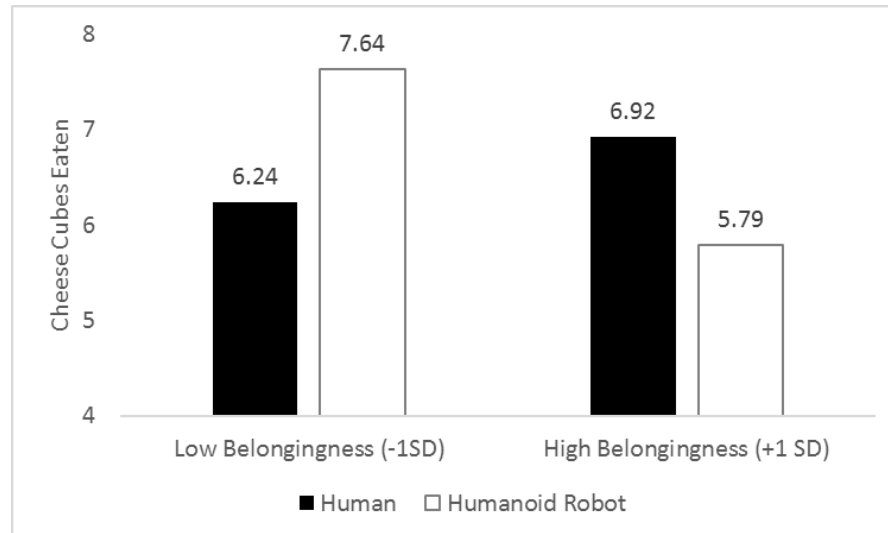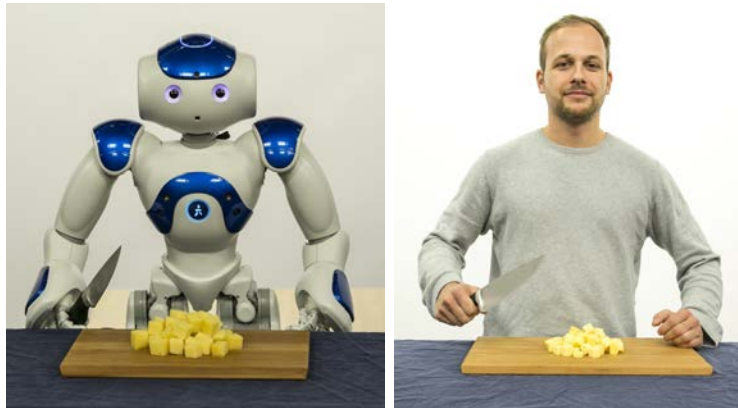

FIGURE 3: EFFECTS OF MEASURED SOCIAL BELONGINGNESS AND SERVICE TYPE ON ACTUAL FOOD CONSUMED (STUDY 3B)

Panel A: HSR and Human in Study 1A (screen capture from videos)

Panel B: HSR and Human in Study 1B and Study 2 (screen capture from videos)

Panel C: HSR and Human in Studies 1C, 3A, and 3B

HSR   **Human**