

Products as Pals: Engaging with Anthropomorphic Products Mitigates the Effects of Social Exclusion

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Feeling left out has been shown to trigger primal, automatic responses in an attempt to compensate for threats to social belongingness. Such responses typically involve reconnection with other human beings. However, four experiments provide evidence that exposure to or interaction with anthropomorphic consumer products (i.e., products featuring characteristics of being alive through design, interaction, intelligence, responsiveness, and/or personality) can also satisfy (at least partially) social needs, ultimately mitigating previously documented effects of social exclusion. Specifically, interacting with anthropomorphic (vs. nonanthropomorphic) products following social exclusion reduces (1) the need to exaggerate the number of one's current social connections, (2) the anticipated need to engage with close others in the future, and (3) the willingness to engage in prosocial behavior. These effects are driven by a need for social assurance, rather than positive affect. Moreover, an important boundary condition exists: drawing attention to the fact that an anthropomorphic product is not *actually* alive (i.e., the product does not provide genuine human interaction) limits its ability to fulfill social needs. Thus, in a time when consumer products are becoming increasingly anthropomorphic in design and function, the results reveal potentially important consequences for human-to-human relationships.

Keywords: social exclusion, anthropomorphism, compensatory consumption, belonging, prosocial behavior, misattribution

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You owned your car for four years. You named it Brad. You loved Brad . . . and then you totaled him. You two had been through everything together. . . . Nothing can replace Brad.

—Liberty Mutual Insurance commercial

From automobiles to automatic vacuum cleaners, toys to technological assistants, the anthropomorphization of consumer products has increased in recent years. Whether naming a car, like “Brad” in the Liberty Mutual commercial, or addressing Microsoft’s Cortana, Apple’s Siri, or Amazon’s Alexa by name, consumers often attribute humanlike qualities and characteristics to everyday products. Beyond naming products, the rapid evolution of the Internet of Things—consumer products able to communicate among themselves, with the environment, and/or with human users (Gubbi et al. 2013)—has produced products that seem “alive” through

interactivity, intelligence, responsiveness, and even personality.

This desire to engage with products that seem alive is consistent with theories arguing that humans possess a fundamental need to belong and engage with living others (Baumeister and Leary 1995; Maslow 1943). When this need is threatened, people frequently engage in compensatory behaviors in an attempt to restore their sense of belonging (Mandel et al. 2016). For example, socially excluded individuals may seek out new sources of affiliation both directly with other people (Maner et al. 2007) and/or indirectly through prosocial behavior (Lee and Shrum 2012). In this article, we investigate whether interacting with a nonhuman, yet anthropomorphic, consumer product can fulfill belongingness needs following an experience of social exclusion, thereby reducing the need to engage in compensatory behaviors. If so, then the relationship between threats to social belonging and the compensatory power of engaging with anthropomorphic products could have important implications regarding people's motivation to seek out actual social connection.

THEORETICAL BACKGROUND

Needs, Threats to Need Fulfillment, and Compensatory Behaviors

Needs are defined as a set of inherent, universal requirements that must be satisfied for survival. In addition to physiological needs for food, water, and shelter, individuals must also fulfill social needs. Evolutionary and developmental theories suggest that humans, in general, are hardwired to seek close connections to other humans (Baumeister and Leary 1995; Maslow 1943). Relatedly, social production function theory posits that social well-being is one of only two universal human goals, the other being physical well-being (Ormel et al. 1999; Steverink and Lindenberg 2006). Taken together, these theories converge on the idea that social needs are vital to the human experience.

Fundamental social needs are so integral to the human experience that threats to these needs often motivate individuals to restore balance, which prior work suggests can be done either directly or symbolically through compensatory processes. For example, threats to power can result in individuals deliberately attempting to restore lost feelings of control via choice (Inesi et al. 2011). Similarly, when one's need for social belonging is threatened, people are faster at recognizing smiling faces in a crowd and focusing on positive, social faces as opposed to unhappy faces or positive, nonsocial images (DeWall, Maner, and Rouby 2009). These latter results provide support for the social reconnection hypothesis, which posits that the experience of social exclusion (i.e., a primary threat to belongingness needs) motivates individuals to seek out new sources of

social acceptance (Maner et al. 2007). Thus, in many instances, threats to an individual's needs increase motivation to restore those needs directly.

Of course, compensating for a threat to need fulfillment is not always so direct. A recent review of the literature highlights how consumer products and experiences can act as compensatory mechanisms for threats to need fulfillment (Mandel et al. 2016). For example, when the need for power is threatened, people increase their willingness to pay for consumer products associated with high status, but not low status (Rucker and Galinsky 2008) and express a stronger preference for larger-sized food options (Dubois, Rucker, and Galinsky 2012). Additionally, when the need for social belonging is threatened, individuals frequently compensate with consumer products. For instance, socially excluded individuals have been found to actively choose nostalgic brands (Loveland, Smeesters, and Mandel 2010) and consumer products that signal or reinforce affiliation with others (Mead et al. 2011; Wan, Xu, and Ding 2014). Thus, consumer products may provide another means of compensating for threats to social need fulfillment. In the current article, we build upon previous work by asking the novel question: Can engaging with anthropomorphic, nonhuman products also satisfy social belonging needs in a compensatory way? Some extant findings provide indirect evidence that this may, in fact, be possible.

Anthropomorphic Products

Humans have integrated anthropomorphic features into products since behavioral modernity (50,000–10,000 BC; Trinkaus 2005), but it is only within the past decade that researchers have started to study the psychological consequences of engaging with anthropomorphic products. Previous work demonstrates that anthropomorphism can undermine self-control (Hur, Koo, and Hoffman 2015), affect the preferences of materialistic consumers (Kim and Kramer 2015), lead consumers to act in brand-consistent ways (Aggarwal and McGill 2012), and lead people to attribute human qualities and more favorable evaluations to consumer products (Aggarwal and McGill 2007; Touré-Tillery and McGill, 2015). Anthropomorphic versions of consumer products have even been shown to elicit greater moral care from consumers and greater trust in nonhuman technological products like polygraph tests and autonomous vehicles (Waytz, Cacioppo, and Epley 2010; Waytz, Heafner, and Epley 2014).

With respect to social needs and anthropomorphism, prior research has shown that people who feel chronically disconnected from others or who are made to feel lonely often attribute anthropomorphic qualities to a variety of objects and entities (e.g., religious agents, pets, imaginary creatures) more than individuals who feel connected (Epley et al. 2008a, 2008b; Epley, Waytz, and Cacioppo 2007; Niemyjska and Drat-Ruszczak 2013). Chen, Wan,

and Levy (2016) extended these findings to the marketplace, demonstrating that socially excluded individuals exhibit a greater preference for anthropomorphic brands than nonexcluded individuals due to a heightened need for affiliation. Note that these authors measured purchase intentions, brand attitudes, and brand choice as outcomes of interest. The present work goes a step further by considering how interacting with anthropomorphic products influences downstream consequences beyond valuation of the products themselves.

When considered together, the relatively separate literatures on social need fulfillment and anthropomorphism suggest an interesting interplay between social belongingness and consequences for/of anthropomorphic products. What has not yet been tested is the degree to which social exclusion and anthropomorphic products interact such that the latter could potentially interfere with the compensatory behaviors that typically follow experiences of the former. We propose that socially excluded individuals will engage in the typical compensatory behaviors designed to reestablish social connection *unless* given the opportunity to engage with an anthropomorphic consumer product. We predict that anthropomorphic products operate by (at least partially) satisfying one's need for social assurance. In the present article, we henceforth refer to the need for social assurance to capture an individual's need for belongingness, companionship, and affiliation (Lee and Robbins 1995). The implication is that anthropomorphic consumer products can, to some extent, fulfill an individual's need for social assurance, which in turn mitigates the need to engage in compensatory behaviors to reconnect with others.

Positive Affect as an Alternative Explanation

Although intuition suggests that social exclusion should have a negative impact on mood, such mood effects are not always consistent, as social exclusion has also been shown to lead to physical and emotional insensitivity (DeWall and Baumeister 2006). Other research finds no mediating effect of mood on dependent variables of interest (Baumeister et al. 2005; Baumeister and DeWall 2005; Twenge et al. 2001; Twenge, Catanese, and Baumeister 2002). Of course, reminding individuals of experiences in which they were socially excluded has the potential to be unpleasant. With respect to potential changes in affect stemming from social exclusion, it is possible that exposing socially excluded individuals to anthropomorphic consumer products, whether anthropomorphized physically (i.e., by design) or psychologically (i.e., imbued with humanlike characteristics), may help restore mood and, in doing so, eliminate the individual's need to reconnect with another human being to achieve a similar end.

Some research supports this alternative explanation. For example, socially excluded individuals became more likely to engage in prosocial behavior when provided the

opportunity to touch a teddy bear, which elicited positive emotion (Tai, Zheng, and Narayanan 2011). Note that Tai et al. (2011) examined touch as a fundamental human need dating back to infancy. Teddy bears are attachment objects that provide direct tactile comfort, much like "cloth mothers" did in Harlow's (1958) seminal studies with rhesus macaques. Other research has also shown that a need to belong heightens preferences for nostalgic products (Loveland et al. 2010), which could (arguably) be one reason why participants felt more positively about a common childhood toy like a teddy bear.

Although social exclusion has the potential to negatively affect one's mood, we propose that the need for social assurance has a separate and distinct effect on compensatory behaviors following an experience of social exclusion. Although mood may certainly be affected by social exclusion and anthropomorphic products may certainly increase positive affect, we propose that the mechanism underlying an anthropomorphic product's effect of mitigating or eliminating compensatory behaviors following social exclusion rests in these products' ability to fulfill social assurance needs.

OVERVIEW OF THE PRESENT RESEARCH

The goal of the present research is to examine whether introducing an anthropomorphic product to consumers mitigates previously documented compensatory behaviors that typically follow an experience of social exclusion. In essence, we suggest that there may be a degree of fluidity between people and products such that both are capable of satisfying social belongingness needs (we return to this topic of fluidity in the General Discussion). If consumers perceive a void in fulfilling social needs via interpersonal interactions, they may derive similar social benefits via interactions with anthropomorphic products. Importantly, however, fulfilling social needs via anthropomorphic products may then come at a cost to seeking out or engaging in genuine interpersonal interaction.

We test these predictions in a series of four experiments. Our general approach involves manipulating social exclusion, having individuals engage with anthropomorphic or nonanthropomorphic versions of the same consumer products, and then studying the consequences for well-established compensatory behaviors. Specifically, we focus on current social connections (experiment 1), future social interaction (experiment 2), and prosocial behavior (experiment 3). We vary the manner and extent to which common consumer products are anthropomorphized (e.g., physical design, psychological construal), measure need for social assurance to capture the proposed underlying mechanism (experiments 3 and 4), and identify a boundary condition by proposing and testing a misattribution account

(experiment 4). We demonstrate that the need for social assurance is not diminished in response to an anthropomorphic product when attention is drawn to the fact that the product is not actually alive. This suggests that the phenomenon may operate primarily at an automatic, implicit level.

EXPERIMENT 1: ESTIMATES OF CURRENT SOCIAL CONNECTIONS

Experiment 1 provides an initial test of our predictions in the context of current interpersonal relationships. Specifically, we examined the effect of product anthropomorphism on perceived number of Facebook friends, a timely measure of social connection and affiliation (Ellison, Steinfield, and Lampe 2007; Wilcox and Stephen 2013). This measure is relevant to our framework because lonely individuals have been shown to rely on virtual connections as a means of fulfilling social needs (Shaw and Gant 2002). Whether by bolstering self-esteem (Forest and Wood 2012) or providing physical comfort—for example, the Like-a-Hug inflatable jacket connects directly to one's Facebook account and expands each time someone “likes” the wearer's wall posts (Kooser 2012)—being reminded of one's Facebook connections may boost feelings of inclusiveness and belonging.

On average, socially excluded individuals may engage in compensatory behavior, which would involve estimating a higher (perceived) number of Facebook friends to compensate for this exclusion. Doing so may be a protective mechanism, as prior research indicates that larger Facebook networks and larger estimated audiences (i.e., the number of people viewing one's posts and status updates) are associated with higher levels of life satisfaction and perceived social support (Manago, Taylor, and Greenfield 2012). Thus, people who feel socially isolated may be particularly motivated to estimate a high number of contacts. Our experiment builds upon this reasoning by introducing an opportunity to engage with a consumer product prior to estimating one's number of online social connections. We hypothesized that socially excluded participants engaging with an anthropomorphic product would report relatively *fewer* friends than socially excluded participants engaging with a nonanthropomorphic product, as the need to engage in compensatory behavior has been minimized. The latter group's estimates will be relatively higher because the nonanthropomorphic product lacks the humanlike qualities that would have satisfied their need for social assurance. We do not anticipate a difference for non-socially excluded (“control”) participants because their social needs have not been threatened; friend estimates for these groups should not differ as a function of interacting with an anthropomorphic versus a nonanthropomorphic product.

Participants and Procedure

A total of 118 undergraduate students ($M_{\text{age}} = 20.3$, $SD = .89$; 36% female) from the University of Michigan completed the experiment for course credit. Participants were told that they would be completing a series of tasks for lab efficiency purposes. The first task was described as a study regarding people's ability to recall past events. Participants were randomly assigned to either a social exclusion or control condition. Drawing upon previous work (Epley et al. 2008a, 2008b; Pickett, Gardner, and Knowles 2004), participants in the social exclusion essay condition wrote about a time they were excluded at a very important social event. In the control essay condition, participants were asked to report what they did yesterday (Reynolds, Brewin, and Saxton 2000). After writing their essay for a minimum of three minutes, participants indicated their general mood ($-5 = \text{very negative mood}$, $5 = \text{very positive mood}$). We included this item to test whether subsequent effects were mediated by changes in mood due to the essay manipulation. However, based upon prior research (Baumeister et al. 2005; Baumeister and DeWall 2005; Twenge et al. 2001), we did not expect differences in mood to mediate the effects of social exclusion.

After the mood measure, participants were told that they would be moving on to a new task regarding cellular phones. All participants indicated that they owned a phone (98% owned a smartphone capable of internet connectivity, which is whom we targeted with our manipulation of anthropomorphism). Participants were directed to retrieve their phones and to keep them on the table as they completed the rest of the experiment. The first question instructed participants to hold their phone in the palm of their hand and to indicate the size of the phone based on whether it was wider than, smaller than, or the same width as their four fingers (excluding their thumb). This was done to ensure engagement with the product. Next, participants were randomly assigned to one of two phone conditions, operationalized with a series of anthropomorphic or nonanthropomorphic questions. Both sets of questions included 10 items pertaining to the design, sound, functionality, connectivity, user interface, camera, applications, battery life, alarm, and security of their phone (for the full list of questions, see the appendix). The difference was that the questions in the anthropomorphic condition were written with lifelike, agentic phrasing (e.g., “How would you rate the overall body and design of your phone [i.e., the body, the weight, the curves]?” and “How would you rate how well your phone does work? Does the phone perform tasks easily?”), while questions in the nonanthropomorphic condition were written with relatively neutral phrasing (e.g., “How would you rate the overall design of your phone [i.e., the case, the shape, the edges]?” and “How would you rate the functionality of your phone? Does the phone allow you to complete tasks easily?”).

To ensure that the set of anthropomorphic questions was perceived as more lifelike than the set of nonanthropomorphic questions, we conducted a separate pretest among 125 students drawn from the same population ($M_{age} = 20.5$, $SD = .69$; 26% female). All participants completed two tasks in a counterbalanced order. In one task, participants rated either the anthropomorphic or nonanthropomorphic set of 10 questions on a scale where 1 = very product-oriented, functional and 7 = very person-oriented, humanlike ($\alpha = .85$). The other task was a forced-choice exercise in which both versions of the sentence were presented to participants and they had to categorize them as either product- or person-oriented. The results from the scale task confirmed that the anthropomorphic set of questions was evaluated as significantly more person-oriented than the nonanthropomorphic set ($M = 3.84$, $SD = 1.35$ vs. $M = 3.13$, $SD = 1.16$; $t(123) = 3.15$, $p = .002$). The categorization results exhibited a similar effect such that, on average, 78% of participants identified the anthropomorphic questions as person-oriented over product-oriented. These results indicate that the questions, identical in meaning but different in the degree to which the wording signals anthropomorphism, cue more person- or product-oriented associations based on subtle wording differences. That these differences emerged without any manipulation of social exclusion is a more conservative test, as prior research suggests individuals might be even more sensitive to anthropomorphic cues following social exclusion (Epley et al. 2008a, 2008b).

Following the phone manipulation, participants were directed to an ostensibly unrelated questionnaire about their social networking habits and demographic information. The key question of interest asked participants to estimate

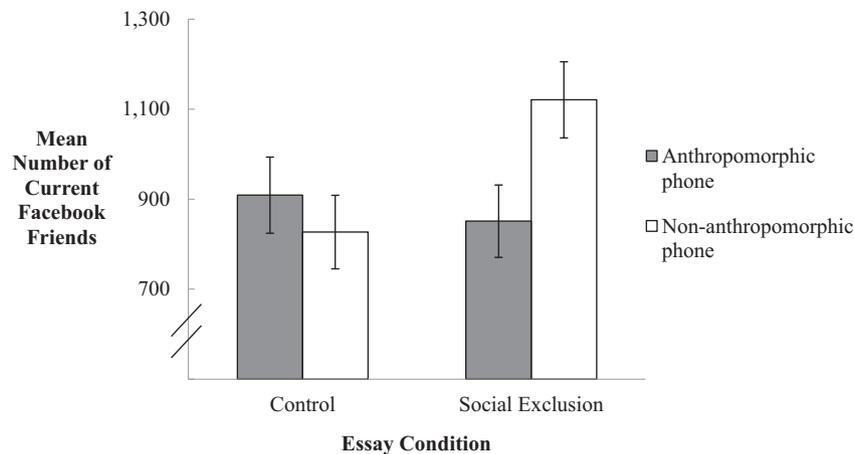
the number of Facebook friends they currently have (one participant did not provide an estimate, so analyses were based upon 117 participants). The open-ended nature of this question lends itself to the possibility that all participants might inflate the estimated number compared to actual numbers. As a point of comparison, we asked a separate group of 142 students ($M_{age} = 19.7$, $SD = .91$; 56% female) from the same population to estimate how many Facebook friends they currently had. The mean number was 917 friends ($SD = 618$), which served as a reasonable approximation to reality.

Results and Discussion

Overall, participants in our sample estimated having an average of 923 Facebook friends, which was virtually equivalent to our pretested value of 917. Importantly, the results of a 2 (essay) \times 2 (phone) analysis of variance (ANOVA) revealed a significant interaction ($F(1, 113) = 4.51$, $p = .036$; see figure 1). Because our primary focus is on relative effects within each essay condition, we began by examining differences within the social exclusion and control conditions. Consistent with our predictions, planned contrasts revealed that socially excluded participants who were asked anthropomorphic questions estimated having significantly fewer friends than socially excluded participants asked nonanthropomorphic questions ($M = 851$, $SD = 446$ vs. $M = 1,121$, $SD = 432$; $t(113) = 2.31$, $p = .023$), suggesting a weakened compensatory effect of exclusion. Conversely, control participants did not differ in their estimates as a function of answering anthropomorphic or

FIGURE 1

NUMBER OF CURRENT FACEBOOK FRIENDS AS A FUNCTION OF ESSAY CONDITION AND PHONE TYPE (EXPERIMENT 1)



NOTE.—Error bars represent one standard error above and below the mean.

nonanthropomorphic questions ($M = 909$, $SD = 429$ vs. $M = 827$, $SD = 479$; $t(113) = .70$, $p = .49$).

In order to draw conclusions about the nature of the phone increasing or decreasing estimates, we also analyzed differences across essay conditions. Among those answering nonanthropomorphic questions, socially excluded participants estimated having significantly more friends than control participants ($t(113) = 2.50$, $p = .014$). This compensatory effect was not present among those answering anthropomorphic questions; estimates between socially excluded and control participants did not differ ($t(113) = .50$, $p = .62$), suggesting that the anthropomorphic cues satisfied excluded participants' need for social assurance. Moreover, if the true number of Facebook friends in the sample population is 917 (the reference point identified previously), then the only people overestimating the size of their social circle are the socially excluded individuals who were not given the opportunity to interact with an anthropomorphic product (1,121 vs. 917; one-sample t -test, $t(27) = 2.50$, $p = .019$). The other three groups' mean estimates did not significantly differ from 917 ($ts \leq 1.03$, $ps \geq .31$).

The next set of analyses was conducted to examine alternative explanations for our findings. First, it is possible that open-ended data resulted in undue influence by outliers. We do not believe outliers are problematic, however, because no participants provided estimates greater than three standard deviations above the mean, and only five participants provided estimates greater than two standard deviations above the mean. If we eliminate these five cases from our data, the interaction remains significant ($F(1, 108) = 4.49$, $p = .036$), along with the pattern of contrasts. Specifically, socially excluded participants who were asked anthropomorphic questions still estimated having significantly fewer friends than socially excluded participants asked nonanthropomorphic questions ($M = 813$, $SD = 399$ vs. $M = 1,049$, $SD = 356$; $t(108) = 2.27$, $p = .025$). Again, control participants did not differ in their estimates as a function of answering anthropomorphic or nonanthropomorphic questions ($M = 861$, $SD = 353$ vs. $M = 786$, $SD = 432$; $t(108) = .72$, $p = .47$). Next, we conducted an analysis using the median absolute deviation (MAD) because standard deviations are themselves influenced by outliers (Leys et al. 2013). We followed Leys et al.'s (2013) four-step process to calculate a MAD value and detect outliers. Using a deviation of 3 units resulted in zero outliers (no one reported having more than 2,234 friends); using a deviation of 2 units resulted in six outliers (those with estimates greater than 1,790 friends). Eliminating these six people actually strengthens the key interaction ($F(1, 107) = 5.88$, $p = .017$) and pattern of contrasts. Taken together, we have confidence that our results are not meaningfully influenced by extremely high friend estimates.

Although previous research suggests that general mood does not mediate the effects of social exclusion, we also

tested whether mood drives friend estimates. First, there was no significant interaction between essay and phone on mood ($F(1, 114) = .25$, $p = .62$). Second, mood differences did not predict friend estimates ($B = 6.32$, $t(115) = .33$, $p = .74$). Third, we used a moderated mediation model to test whether the relationship between essay ($-.5 = \text{control}$, $.5 = \text{social exclusion}$) and friend estimates was mediated by mood, and whether the indirect effect differed by phone type ($-.5 = \text{nonanthropomorphic}$, $.5 = \text{anthropomorphic}$; model 8 in Hayes 2013). When we controlled for the nonsignificant effect of mood on friend estimates ($B = 16.74$, $t(112) = .82$, $p = .41$), the original interaction between essay and phone on friend estimates holds ($B = -357.24$, $t(112) = 2.15$, $p = .034$). Nonsignificant indirect effects for both the anthropomorphic phone ($B = -23.78$; 95% CI: $-118.30, 29.86$) and nonanthropomorphic phone ($B = -29.38$; 95% CI: $-127.60, 42.99$) cast further doubt on a mood mechanism.

Another alternative explanation for our findings is that participants in the anthropomorphic phone condition believed that their phone was better or superior compared to participants in the nonanthropomorphic phone condition. Other ways of affirming oneself ("At least I have a great phone!") could feasibly mitigate adverse effects of social exclusion and render an anthropomorphic product's need to do so unnecessary (Steele 1988). However, analyses of the 10 attribute questions revealed no significant differences between the phone conditions ($ps > .13$ with an average p -value of .49). Thus, it is not the case that participants in the anthropomorphic condition elevated the status of their phone. These results (coupled with the pretest) provide greater confidence that the results are due to the anthropomorphic construal of the phone itself.

In sum, socially excluded participants interacting with an anthropomorphic phone reported significantly fewer Facebook friends than their counterparts interacting with a nonanthropomorphic phone. This latter group may have engaged in compensatory behaviors when forming their estimates following an experience of social exclusion. We propose that the lifelike qualities in a product may fulfill the need to reconnect and make the compensatory effect for socially excluded participants disappear. The results of experiment 1 support this reasoning with a present, immediate measure of social assurance. However, it should also be the case that socially excluded individuals compensate in a similar manner for *future* interaction unless given the opportunity to engage with an anthropomorphic product. We test this possibility next.

EXPERIMENT 2: ESTIMATES OF FUTURE SOCIAL INTERACTION

The social reconnection hypothesis posits that socially excluded individuals are motivated to seek affiliation

(Maner et al. 2007). This drive is inherently forward-looking and focused on building interpersonal bonds, especially with *new* social partners (i.e., others who are “perceived as providing realistic sources of renewed affiliation”; Maner et al. 2007, 43). We extend this hypothesis to *current* social partners. In experiment 1, we examined individuals’ perceptions of their existing Facebook friend circle. In experiment 2, we shift to a forward-looking dependent variable that better captures the underlying drive to reconnect: anticipated interaction with family and friends.

A second goal was to examine the affect-based alternative explanation more directly. Although we found no evidence of mood mediation in experiment 1, a single global item may not have been sensitive enough to capture subtle affect changes. Thus, we included a more nuanced measure of affective states in experiment 2. More importantly, it is also possible that participants found it difficult to accurately report their mood. To test whether the observed effects were due to a shift in mood elicited by an anthropomorphic product, we introduced a nonanthropomorphic, positive-mood-inducing version of a consumer product (in addition to anthropomorphic and nonanthropomorphic versions). If mood drives differences among socially excluded individuals, we should find similar results between individuals engaging with a nonanthropomorphic, positive-mood-inducing product and an anthropomorphic product. If mood does not explain the results, however, the positive-mood-inducing product should yield outcomes comparable to those of the nonanthropomorphic product.

A final goal was to demonstrate that prior effects were not unique to our manipulations. Thus, experiment 2 featured Cyberball (Williams, Cheung, and Choi 2000) as our manipulation of social exclusion, and subtle positioning changes of iRobot’s Roomba vacuum cleaner as our manipulation of anthropomorphism.

Participants and Procedure

A total of 327 adults ($M_{\text{age}} = 33.0$, $SD = 10.89$; 56% female) were recruited from Amazon Mechanical Turk (MTurk) in exchange for payment. Participants were told that they would be completing a few different tasks on teamwork and decision making. The first task was described as an “interactive ball-tossing game used for mental visualization” that would entail working with online partners connected over the researchers’ network. In reality, this task was Cyberball 4.0 and served as our manipulation of social exclusion (Williams et al. 2012). Participants were randomly assigned to either the exclusion or inclusion condition, which both entailed tossing the ball with three other participants who were ostensibly logged on to the external website. During the game’s 30 ball tosses, participants were instructed to simulate the entire experience as if it were happening in real life. Participants in the exclusion

condition received the ball three times at the beginning of the game but were then excluded the remainder of the game. Participants in the inclusion condition received approximately one-fourth of all tosses throughout the game. We opted to use an inclusion condition instead of the control condition (where participants simply watch other virtual players without tossing the ball themselves) to ensure a similar level of engagement between conditions. Moreover, previous research in consumer behavior generally features the inclusion comparison as a point of reference for the effects of exclusion (Chen et al. 2016; Duclos, Wan, and Jiang 2013; Loveland et al. 2010).

After Cyberball ended, participants were told they would be participating in a focus group regarding a consumer product. On the next screen, all participants were shown a Roomba vacuum, but the computer randomly assigned participants to one of three conditions: (1) the anthropomorphic condition, in which the product was positioned to look like a face, (2) the nonanthropomorphic condition, in which the product was turned 90 degrees and, therefore, did not look like a face, or (3) the nonanthropomorphic, positive condition (we will simplify this name to “positive” throughout), which featured the nonanthropomorphic Roomba but with a tropical beach skin (see figure 2). Roomba skins are available for purchase and come in a variety of designs (e.g., as of December 2016, Amazon sells about 350 options). To ensure that the positive Roomba was perceived as eliciting more positive affect than the other two Roombas, we conducted a pretest with a separate sample from MTurk ($n = 154$). Participants were randomly assigned to view one of the three Roombas and answer two questions pertaining to mood (“If you were trying to perk up someone’s mood, how much do you think the following Roomba design would put someone in a good mood?” where 1 = extremely unlikely and 9 = extremely likely, and “How much worse/better would you feel seeing this Roomba in action [cleaning]?” where -10 = much worse and 10 = much better). Answers to these two questions were significantly correlated ($r(152) = .59$, $p < .001$), so we averaged standardized scores to form a positivity index. Planned contrasts revealed that the positive Roomba ($M = .46$, $SD = .79$) elicited significantly more positivity than either the anthropomorphic Roomba ($M = -.15$, $SD = .87$; $t(151) = 3.73$, $p < .001$) or the nonanthropomorphic Roomba ($M = -.31$, $SD = .83$; $t(151) = 4.64$, $p < .001$), which, in turn, did not differ from each other ($t(151) = .97$, $p = .33$). Thus, the positive Roomba elicits positive affect, but the anthropomorphic Roomba’s “smile” does not.

Furthermore, to ensure that the Roomba manipulation was subtle and not too heavy-handed, we conducted a pretest with another separate sample recruited from MTurk ($n = 51$). Participants viewed either the anthropomorphic or nonanthropomorphic Roomba and were asked to list the first five words that came to mind. No one in either

FIGURE 2

THREE ROOMBA VACUUM CLEANER CONDITIONS (EXPERIMENT 2)



Anthropomorphic

Non-anthropomorphic

Non-anthropomorphic, Positive

condition mentioned words like “face,” “smile,” “grin,” or “happy.” Instead, words like “vacuum,” “cleaner,” and “helpful” were more common. Thus, given that zero free responses out of 255 total responses mentioned a single facial characteristic, we can have some confidence that any effects attributable to product exposure are happening below participants’ conscious awareness. (We return to the implicit nature of anthropomorphism in experiment 4.)

After viewing the Roomba, participants completed a few consumer-related questions to boost the credibility of our cover story (e.g., likelihood of purchase, willingness to pay for a Roomba; the results from these items did not significantly differ across conditions). We then presented our key dependent variable of interest: “If you had to estimate how much time you will spend talking on the phone to family or friends in the upcoming month, would you say you will spend less time than average, an average amount of time, or more time than average?” (1 = much less time than average and 7 = much more time than average). Immediately following this question, participants rated the extent to which they currently felt angry, caring, energetic, happy, lonely, sad, and tired on five-point scales where 1 = does not describe me at all and 5 = describes me extremely well. We included these measures to further examine the role of affect in driving the effects of anthropomorphism on phone estimates. Our choice of these seven items was deliberate, as we wanted to select items related to exclusion (e.g., lonely) as well as those varying in valence and arousal (Russell 1980).

Lastly, participants completed an attention check (select “3” from the options provided), demographic questions, and hypothesis-guessing questions. Twenty-one individuals who answered the attention check incorrectly were eliminated from analysis, resulting in a sample size of 306 ($M_{\text{age}} = 33.2$, $SD = 11.01$; 61% female). We also asked participants whether or not they had played Cyberball before and/

or were aware of its purpose. Of the 306 remaining participants, 45 indicated “yes” or “maybe” to the question (e.g., they had seen it through psychology coursework or other MTurk experiments) and were eliminated from analysis. After the 45 non-naïve participants were removed, our final sample consisted of 261 adults ($M_{\text{age}} = 32.5$, $SD = 10.39$; 62% female). Following these questions, all participants were fully debriefed and awarded payment.

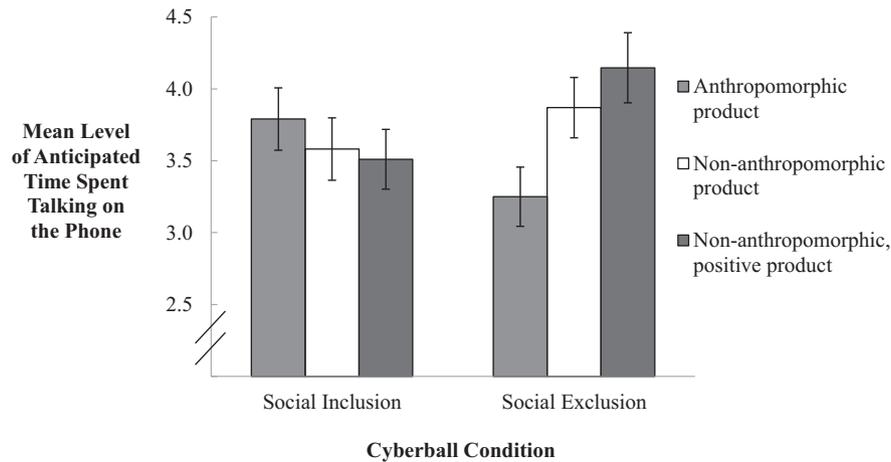
Results and Discussion

The results of a 2 (Cyberball) \times 3 (Roomba) ANOVA revealed a significant interaction on participants’ anticipated interaction with family and friends ($F(2, 255) = 3.88$, $p = .022$; see figure 3). Note that the interaction remains significant and the pattern of results is unchanged when we include the 45 non-naïve participants in the analysis ($F(2, 300) = 3.26$, $p = .040$).

Because our primary focus is on relative effects within each Cyberball condition, we examined two sets of planned contrasts—one for social exclusion and one for social inclusion. First, among socially excluded participants, those who viewed the anthropomorphic Roomba anticipated spending significantly less time on the phone than those who viewed the nonanthropomorphic Roomba ($M = 3.25$, $SD = 1.19$ vs. $M = 3.87$, $SD = 1.54$; $t(255) = 2.11$, $p = .036$) or the positive Roomba ($M = 4.15$, $SD = 1.58$; $t(255) = 2.81$, $p = .005$). Thus, socially excluded participants who did not view the anthropomorphic Roomba reported engaging in the predicted compensatory behaviors following social exclusion, whereas those who viewed the anthropomorphic Roomba exhibited no such compensatory behavior. The two social exclusion conditions featuring nonanthropomorphic Roombas did not differ ($t(255) = .86$, $p = .39$). Presumably, exposure to an anthropomorphic product fulfills socially excluded individuals’ need to

FIGURE 3

ANTICIPATED LEVEL OF INTERACTION AS A FUNCTION OF CYBERBALL CONDITION AND PRODUCT TYPE (EXPERIMENT 2)



NOTE.—Error bars represent one standard error above and below the mean.

belong, resulting in reduced motivation to reconnect with family and friends as a compensatory behavior. Second, the results for socially included participants revealed no differences in estimates among those viewing the anthropomorphic ($M = 3.79$, $SD = 1.46$), nonanthropomorphic ($M = 3.58$, $SD = 1.31$), or positive Roomba ($M = 3.51$, $SD = 1.47$; $ts \leq .93$, $ps \geq .35$).

For completeness, we also analyzed differences across Cyberball conditions. While the anthropomorphic Roomba leads excluded (vs. included) participants to seek marginally less future interaction ($t(255) = 1.81$, $p = .072$), the positive Roomba leads them to seek significantly more interaction ($t(255) = 1.98$, $p = .048$). This divergence provides further evidence that anthropomorphism's effect on social outcomes is not due to positive mood. Lastly, there was no difference in estimates between excluded and included participants viewing the nonanthropomorphic Roomba ($t(255) = .95$, $p = .34$).

In addition to including a positive-mood-inducing Roomba (per the pretest) in our experimental design, we measured affective responses following our key dependent variable. Including these items allowed us to examine whether the observed effects were mediated by changes in self-reported affect. Our analysis approach is consistent with that followed by Mead et al. (2011). First, we examined whether there was a significant interaction between Cyberball and Roomba on any of the seven items. The results revealed a significant interaction for two of the items: "happy" ($F(2, 255) = 4.16$, $p = .017$) and "energetic" ($F(2, 255) = 4.09$, $p = .018$). There were no significant interactions for the five remaining items ($ts < 1.86$, $ps \geq .16$). Second, feeling happy and feeling energetic were

each predictive of greater anticipated interaction ($Bs \geq .27$, $ps \leq .001$). Third, we used moderated mediation models to test whether the relationship between Cyberball ($-.5 =$ social inclusion, $.5 =$ social exclusion) and anticipated interaction was mediated by feeling happy and/or energetic, and whether the indirect effects differed by Roomba (model 8; Hayes 2013). Because the Roomba factor consisted of three levels, we used dummy codes so that the anthropomorphic Roomba served as the reference category (Hayes and Preacher 2014). When we compared the anthropomorphic Roomba against the positive Roomba, there were significant indirect effects for feeling happy and feeling energetic among those viewing the positive Roomba (happy: $B = -.13$; 95% CI: $-.34, -.02$; energetic: $B = -.15$; 95% CI: $-.37, -.01$), but not for the anthropomorphic Roomba (happy: $B = .05$; 95% CI: $-.02, .19$; energetic: $B = .01$; 95% CI: $-.11, .13$). Comparing the anthropomorphic Roomba against the nonanthropomorphic Roomba revealed no significant effects for either Roomba (all 95% CIs contained 0). Thus, these positive affective responses can explain the effect of the positive Roomba on anticipated interaction, but do not explain the effect of the anthropomorphic Roomba. These findings suggest that anthropomorphism is operating through a different underlying process, which we propose is a need for social assurance.

Of course, our choice of measuring affect items *after* the key dependent variable presents the possibility that the dependent variable influenced the affective measures (i.e., expecting to talk with family and friends in the future may have enhanced happiness). Thus, our final set of analyses tested for reverse causality with a series of moderated

mediation models featuring anticipated interaction as the mediator and the affect items as the dependent variables (model 8; Hayes 2013). The results revealed no significant indirect effects of the Roomba manipulation on any of the affect items via anticipated interaction (all 95% CIs contained 0), suggesting that the significant indirect effects of feeling happy and feeling energetic on anticipated interaction do not appear attributable to the sequence of measurements.

In sum, the results of experiment 2 replicate the findings of experiment 1 in a forward-thinking context, introduce an alternative manipulation of social exclusion (Cyberball), and provide evidence against positive affect as a potential explanation for the observed effect. As predicted, socially excluded participants engage in compensatory behavior and anticipate spending more time on the phone talking to friends and family unless presented with an anthropomorphic consumer product. Exposure to a positive, nonanthropomorphic consumer product does not mitigate the compensatory behaviors, suggesting the effects are not driven by changes in affect but instead by the anthropomorphic qualities of the product. While feeling happy and/or energized can explain why those viewing the positive Roomba seek greater interaction, affective responses cannot explain why those viewing the anthropomorphic Roomba appear relatively less inclined. Moreover, socially excluded participants did not differ in their anticipated interaction when viewing a positive or neutral version of the same product. This null effect, along with the moderated mediation results, indicates that affective responses alone cannot explain our effects. Instead, we propose that even subtle anthropomorphic product features result in lower motivation to seek interaction because of a lower need for social assurance.

Our next experiment examines this underlying process directly. Experiment 3 also tests whether the consequences observed thus far extend to even less direct means of reestablishing social connections. Previous research has demonstrated that engagement in prosocial behavior is a primary way in which consumers attempt to regain a sense of belonging to compensate for social exclusion (Lee and Shrum 2012). Thus, if it is the case that social exclusion triggers a threat to social belongingness (Maner et al. 2007), then exclusion should heighten one's perceived need for social assurance, which in turn should predict greater engagement in compensatory prosocial behavior. However, engagement with an anthropomorphic product should satisfy that need for assurance and mitigate the need to engage in compensatory prosocial behavior. We examine these predictions in experiment 3.

EXPERIMENT 3: PROSOCIAL BEHAVIOR

In the prior experiments, we find that engaging with anthropomorphic products mitigates the compensatory effects

that typically follow an experience of social exclusion. However, the potential consequences for prosocial behavior, an even less direct means of restoring social connections, remain to be tested. Interestingly, the anthropomorphism and social exclusion literatures both predict increased prosocial behavior but for different reasons. For example, humanizing a social cause (e.g., putting a face on a tree with the expression "Save me!" instead of a tree with no face and the words "Save trees!") leads people to behave more prosocially (Ahn, Kim, and Aggarwal 2014), just as presenting subtle social cues during a dictator game encourages more prosocial giving (Rigdon et al. 2009). Similarly, social exclusion via rejection encourages prosocial behavior (e.g., volunteering, donating) for the purpose of restoring social connections (Lee and Shrum 2012) and/or regaining acceptance into a group (Mead et al. 2011). Both of these literatures would predict an increase in prosocial behavior.

As mentioned earlier, one article (Tai et al. 2011) integrates social exclusion with product interaction and finds that socially excluded individuals are more likely to engage in prosocial behavior when provided an opportunity to touch a stuffed teddy bear. On the surface, these findings seem at odds with our moderated mediation results in experiment 2 that cast doubt on an affective response mechanism. However, upon closer inspection, discrepancies may exist due to fundamental differences in research questions and methods. In addition to the use of a nostalgic consumer product linked directly to childhood, Tai et al. (2011) use an indirect measure of affective responses. Specifically, the authors used an open-ended format to ask participants their reasoning for allocation decisions following the dictator game; responses were then submitted to a linguistic software program for analysis. For these reasons (and our results from experiment 2 featuring mediation and moderation via positive affect), positive emotion is unlikely to be the primary mechanism underlying subsequent effects on prosocial behavior.

Although social exclusion may increase prosocial behavior in some instances (Ahn et al. 2014; Lee and Shrum 2012), it seems possible that social exclusion could actually decrease prosocial behavior if individuals no longer need to compensate for social exclusion. Prior research suggests that social exclusion leads to greater prosocial behavior for the compensatory purpose of reestablishing social connections and group acceptance (DeWall and Richman 2011; Mead et al. 2011). If introducing an anthropomorphic product can satisfy the need to reestablish social connections, our framework predicts that socially excluded individuals may then be less likely to engage in prosocial behavior.

Note that some research does find that certain manipulations of social exclusion decrease prosocial behavior (e.g., informing individuals that they are destined to be alone in the future; Twenge et al. 2007). However, as pointed out

by Lee and Shrum (2012), these manipulations may have threatened other needs beyond belongingness (e.g., autonomy, a meaningful existence). Our own manipulations are in line with Lee and Shrum (2012), who focus on reconciling these findings by examining the underlying processes of social exclusion. We predict that threats to relational needs, on average, will lead individuals to satisfy those needs by engaging in a prosocial, affiliative manner. Importantly, introducing an anthropomorphic product may mitigate this tendency, ultimately resulting in decreased prosocial behavior. In contrast to Tai et al. (2011), who consider the role of positive emotion, experiment 3 explores our proposed underlying process via an established measure of one’s need for social assurance.

Participants and Procedure

A total of 162 participants from MTurk completed the experiment in exchange for payment. Twelve participants were eliminated from analysis because they failed to complete the second portion of the experiment, resulting in a final sample size of 150 ($M_{age} = 29.5$, $SD = 6.93$; 60% female). We used the same 2 (essay: social exclusion vs. control) \times 2 (phone: anthropomorphic vs. nonanthropomorphic) between-subjects design as experiment 1, with a few changes. Importantly, the key dependent variable was participants’ willingness to complete more studies for no additional compensation, a commonly used measure of prosocial engagement (Twenge et al. 2007). We deliberately did not include information regarding the content or topics of those studies to avoid introducing potential confounds.

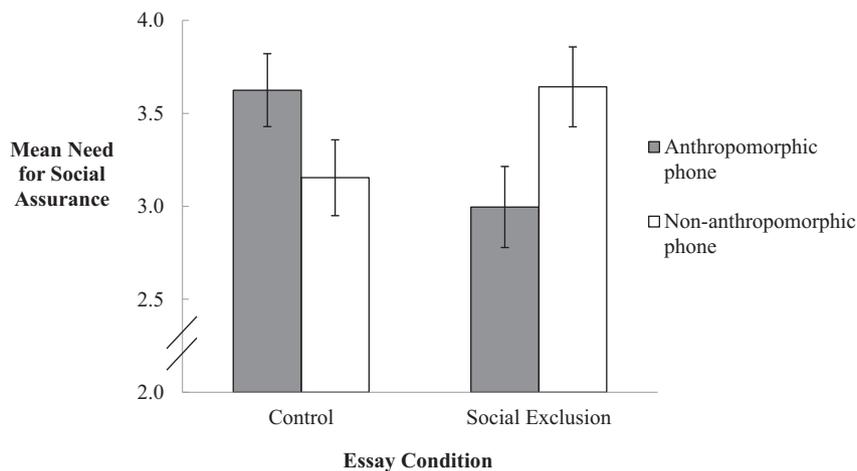
Following the key dependent measure, participants completed an eight-question social assurance scale ($\alpha = .85$; Lee and Robbins 1995). Participants rated their level of agreement with statements like “My life is incomplete without a buddy beside me” and “I wish to find someone who can be with me all the time” (1 = strongly disagree, 7 = strongly agree). Higher scores indicate a greater desire for social connection, whereas lower scores indicate a greater degree of independence or social need satisfaction. Social exclusion, which has been shown to increase motivation to reconnect with others (Maner at al. 2007), should result in higher scores. If anthropomorphic products can fulfill social needs, then socially excluded individuals provided with an anthropomorphic product (1) should report a lower need for social assurance and, subsequently, (2) should be less likely to engage in prosocial behavior for the purpose of reestablishing social connections.

Results and Discussion

Similar to the mediation analysis approach in experiments 1 and 2, we test our mediation hypothesis for social assurance in three steps. First, the results of a 2 (essay) \times 2 (phone) ANOVA revealed a significant interaction with respect to social assurance ($F(1, 146) = 7.20$, $p = .008$; see figure 4). Planned contrasts within the essay conditions revealed that socially excluded participants who were asked anthropomorphic questions reported a significantly lower need for social assurance than those who were asked nonanthropomorphic questions ($M = 3.00$, $SD = 1.08$ vs. $M = 3.64$, $SD = 1.27$; $t(146) = 2.11$, $p = .036$). Conversely, participants in the control condition did not

FIGURE 4

MEAN NEED FOR SOCIAL ASSURANCE AS A FUNCTION OF ESSAY CONDITION AND PHONE TYPE (EXPERIMENT 3)



NOTE.—Error bars represent one standard error above and below the mean.

differ in their need for social assurance when presented with nonanthropomorphic compared to anthropomorphic questions ($M = 3.15$, $SD = 1.31$ vs. $M = 3.63$, $SD = 1.37$; $t(146) = 1.67$, $p = .10$). Second, we find that a lower need for social assurance predicts volunteering for fewer surveys ($B = .26$, $t(148) = 2.73$, $p = .007$). Third, we used a moderated mediation model to test whether the relationship between essay condition ($-.5 =$ control, $.5 =$ social exclusion) and prosocial behavior was mediated by a need for social assurance, and whether the indirect effect differed by phone type ($-.5 =$ nonanthropomorphic, $.5 =$ anthropomorphic; model 8 in Hayes 2013). The results revealed that when we control for the strong positive association between social assurance and prosocial behavior ($B = .28$, $t(145) = 2.82$, $p = .006$), the original interaction between essay and phone type is reduced to nonsignificance ($B = .41$, $t(145) = .80$, $p = .42$). Importantly, the results indicate a significant indirect effect for social assurance among participants who responded to anthropomorphic questions ($B = -.17$; 95% CI: $-.43, -.01$) but not among participants who responded to nonanthropomorphic questions ($B = .14$; 95% CI: $-.03, .35$). Thus, socially excluded participants who interacted with an anthropomorphic product reported a lower need for social assurance, and a lower need for social assurance predicted volunteering for fewer surveys. Although essay condition did not directly influence prosocial behavior ($B = -.14$; $t(148) = .54$, $p = .59$), absence of a “total effect” of essay on volunteering is not problematic theoretically since the absence or presence of a total effect is not a requirement for establishing mediation (Zhao, Lynch, and Chen 2010). Instead, the decrease in compensatory prosocial behavior results from socially excluded individuals having their need for social assurance at least partly fulfilled by their anthropomorphic product.

It is worth noting that our results for social assurance are consistent with prior research that separately explored the relationship between anthropomorphism and prosocial behavior and social exclusion and prosocial behavior. In the control essay conditions, we see the anthropomorphic phone having a priming effect consistent with Ahn et al.'s (2014) and Rigdon et al.'s (2009) “watching eyes” study. Of course, this is a marginally significant difference ($p = .10$), but the direction of the means is consistent with these prior findings. In the social exclusion condition, we see a heightened need for social assurance when one does not receive fulfillment, consistent with the social reconnection hypothesis (Lee and Shrum 2012; Maner et al. 2007). However, when studied simultaneously as in the current article, anthropomorphism and social exclusion interact to influence social need fulfillment and, ultimately, compensatory behaviors that typically follow an experience of social exclusion (e.g., prosocial behavior).

The results from experiment 3 demonstrate that differences in the need for social assurance mediate the relationship between social exclusion and prosocial behavior when

an anthropomorphic product is presented to consumers. Importantly, participants thus far have not reported (1) noticing anthropomorphic product attributes, or (2) recognizing linkages between the product and dependent variables of interest. The seemingly implicit nature of the phenomenon suggests that drawing explicit attention to anthropomorphic qualities may eliminate the observed effects. The final experiment tests what happens when participants are reminded that the lifelike product is not actually alive.

EXPERIMENT 4: MODERATION VIA MISATTRIBUTION

Experiment 3 provides support for the proposed underlying process that the humanlike characteristics of an anthropomorphic Roomba affect feelings of social assurance and, in doing so, influence socially excluded individuals' propensity to engage in prosocial behavior. It seems that participants mistakenly misattribute the humanlike characteristics of an anthropomorphic, but nonliving, consumer product to a source capable of actual social interaction and the social assurance such interaction provides. If so, then calling attention to the fact that the anthropomorphic product is not actually alive (i.e., the anthropomorphic cues are not coming from a real person capable of authentic interaction) should lead individuals to correct their misattribution of social assurance and serve to eliminate or reduce the effect (Chartrand 2005; Mukhopadhyay and Johar 2007). In other words, individuals may realize that the true source of their responses lies in a nonliving consumer product versus a living person, ultimately diminishing the product's ability to satisfy social needs. Our final experiment tests this misattribution account (Zanna and Cooper 1974).

Participants and Procedure

A total of 200 participants ($M_{\text{age}} = 35.5$, $SD = 11.34$; 51% female) from MTurk completed the experiment in exchange for payment. Sixteen participants were eliminated from analysis for failing the attention check, resulting in a final sample size of 184 ($M_{\text{age}} = 36.0$, $SD = 11.54$; 52% female). Following random assignment to the social exclusion or control essay task, participants were told they would be moving on to a new task in which they would be participating in a focus group. On the next screen, all participants were shown the same image of a humanized Roomba. While the anthropomorphic condition was identical to that used in experiment 2, the misattribution condition included a single statement above the product: “We know that the Roomba looks like it's smiling at you, but remember—it's just a machine, not a real person.” Recall that the pretest in experiment 2 suggests that participants in the anthropomorphic condition do not consciously notice the lifelike qualities of the product; we deliberately brought

these qualities to the attention of participants in the misattribution condition.

Participants then completed a series of consumer-related questions to make the cover story more credible (attribute ratings including its perceived reliability, attractiveness, etc.), and were then asked the key dependent variable of interest: the need-for-social-assurance index from experiment 3 ($\alpha = .86$). If the effect is due to participants misattributing their feelings of social assurance to the anthropomorphic characteristics of a nonliving consumer product, then drawing explicit attention to the fact that the product is not alive (i.e., its anthropomorphic characteristics cannot fulfill social needs) should mitigate the effect.

Results and Discussion

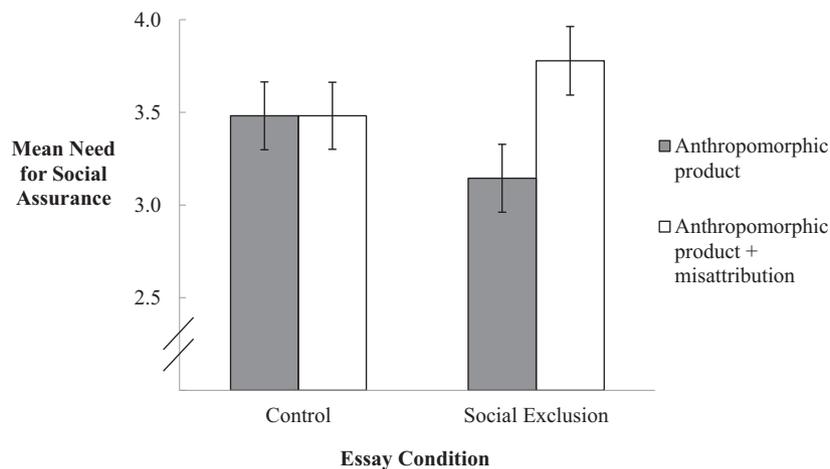
The results from a 2 (essay) \times 2 (Roomba) ANOVA revealed a marginally significant interaction with respect to social assurance ($F(1, 180) = 3.01, p = .085$; see figure 5). Planned contrasts within each essay condition revealed that control participants did not differ in their need for social assurance as a function of viewing the anthropomorphic or misattribution Roomba ($M = 3.48, SD = 1.19$ vs. $M = 3.48, SD = 1.11$; $t(180) = .00, p = 1$). Among socially excluded participants, however, those who viewed the anthropomorphic Roomba reported a significantly lower need for social assurance than those who viewed the same product through a misattribution lens ($M = 3.14, SD = 1.25$ vs. $M = 3.78, SD = 1.40$; $t(180) = 2.44, p = .016$). Differences

within each Roomba condition were not significant ($t_s \leq 1.30, p_s \geq .19$).

The results of experiment 4 support the notion that social need fulfillment via anthropomorphic products happens outside of consumers' conscious awareness. Note that social exclusion did not differentially affect perceptions of the anthropomorphic or misattribution Roombas themselves (e.g., the Roomba's perceived attractiveness, reliability, efficiency; $F_s \leq 1.56, p_s \geq .21$). We would not expect differences on these measures, as the product itself was identical in all conditions. Instead, when explicit attention is directed to the true source of those anthropomorphic characteristics—that is, a nonliving product that does not perfectly duplicate a real human being—the product's ability to fulfill one's need for social assurance is diminished. These findings have implications for the potential interchangeability between humans and products in the minds of consumers. Using fMRI, Yoon et al. (2006) shed light on the distinction between "brand personality" and "human personality." Despite the two sharing similar language and treatment in everyday conversation, brand and human personality were found to have distinct neural correlates. Our findings are consistent such that anthropomorphic products can satisfy (at least partially) social needs typically fulfilled by other humans, unless it is called to one's attention that the anthropomorphic product is not actually alive. Our misattribution manipulation may have nudged consumers from "person processing" to "object processing." Future studies exploring the interchangeability of products and humans will likely reveal more boundary conditions of how and when the two overlap and when they are distinct.

FIGURE 5

MEAN NEED FOR SOCIAL ASSURANCE AS A FUNCTION OF ESSAY CONDITION AND PRODUCT TYPE (EXPERIMENT 4)



NOTE.—Error bars represent one standard error above and below the mean.

GENERAL DISCUSSION

Socially excluded individuals often engage in compensatory behaviors, from choosing products that signal affiliation (Mead et al. 2011) to contributing to charity (Lee and Shrum 2012), for the purpose of reestablishing social connections and restoring the basic need of social belongingness. The present research indicates that anthropomorphic consumer products can actually mitigate these compensatory behaviors. We build upon and extend prior work both on social exclusion and on anthropomorphism that predicts outcomes different than those found herein. For example, while social exclusion *or* exposure to an anthropomorphic product separately predict increased prosocial behavior (Ahn et al. 2014; Lee and Shrum 2014), when studied together, social exclusion followed by engagement with an anthropomorphic product results in decreased prosocial behavior. The reason for this, we contended, is that engaging with anthropomorphic products satisfies the need for social assurance. Socially excluded individuals who would have otherwise engaged in compensatory behaviors no longer need to exhibit such behaviors. Only when individuals are reminded that an anthropomorphic product is not actually alive does its ability to fulfill social assurance needs go away and compensatory behaviors return. This finding leads to speculation that the process underlying the effect involves individuals misattributing the ability to fulfill social assurance needs to a product perceived to be more alive and humanlike (due its anthropomorphic attributes) than it actually is. Once individuals are reminded that the product is not actually alive, the effect disappears.

In a series of four experiments, we test the causal links between social exclusion and anthropomorphic products on compensatory behaviors. The results revealed that interacting with anthropomorphic (vs. nonanthropomorphic) products following social exclusion reduces the need to exaggerate the number of one's current social connections (experiment 1), the anticipated need to engage with close others in the future (experiment 2), and one's willingness to engage in prosocial behavior (experiment 3). Importantly, while the need for social assurance mediates these effects, differences in positive affective responses do not. Socially excluded individuals engaged in compensatory behaviors unless presented with an anthropomorphic product; a positive-mood-inducing product did not thwart the compensatory behaviors, effectively ruling out changes in mood as an alternative explanation (experiment 2). Finally, we identified a boundary condition such that making participants consciously aware that an anthropomorphic product was not actually alive and, thus, could not fulfill their need for social assurance in the way genuine interpersonal interaction might, eliminated the effect (experiment 4).

Taken together, our research employed a variety of manipulations (e.g., Cyberball, Roomba, cell phone

descriptions) and dependent measures (e.g., current social connections, anticipated social interaction, prosocial behavior) to provide support for our main hypothesis: the typical compensatory behaviors of socially excluded individuals can be reduced or eliminated via engagement with an anthropomorphic consumer product.

Theoretically, our results reveal that consumer products can and do, in fact, influence social needs in ways that had been previously discussed but not empirically tested (Baumeister and Leary 1995). Our experiments build upon and extend recent research demonstrating that *greater* social connectedness can lead to the unintentional, negative consequence of dehumanizing other people (Waytz and Epley 2012), by showing that *less* social connectedness (i.e., social exclusion) can potentially have negative consequences on interpersonal interaction if an anthropomorphic product fulfills social needs typically fulfilled by human interaction. Furthermore, the current findings have important implications for prior research showing that social exclusion typically elicits a drive for reconnection (DeWall and Pond 2011; DeWall and Richman 2011; Maner et al. 2007; Mead et al. 2011) and increased engagement in prosocial behavior (Lee and Shrum 2012; Williams 2007). We find that social exclusion *does* lead to compensatory behaviors designed to restore social interaction *unless one interacts with an anthropomorphic product*. By focusing on dependent measures used in prior research—attempts to restore social connection (Mead et al. 2011) and prosocial behavior (Lee and Shrum 2012)—our findings extend prior research by incorporating anthropomorphic products and the potential for such products to fulfill social assurance needs. Future research can continue to explore the interplay between people and anthropomorphic products to uncover contexts in which they are more or less interchangeable and how interactions with one may increase or decrease the appeal of interacting with the other.

In light of consumer neuroscience research on the dissociation of brand and person judgments (Yoon et al. 2006), our findings have an important limitation. Although we demonstrate the ability for anthropomorphic consumer products to fulfill social needs at the expense of interpersonal connection, our data do not speak to whether or not consumer products and humans are perfectly substitutable. To be clear, we do not expect that consumer products satisfy social assurance needs in the exact same way that people do, no matter how anthropomorphic the product may be. Indeed, support for this idea can be found in the misattribution experiment (experiment 4) in which drawing explicit attention to the anthropomorphic product's features mitigates the effect; one would not expect drawing explicit attention to the human characteristics of an actual human to eliminate the ability for a person to fulfill social needs. Although there may be extreme examples of the effect that result in nearly perfect substitutability of a person with a product, such as is implied by extreme hoarding of items at

the cost of real emotional attachments (Frost and Hartl 1996), it is important to note that this is likely an exception rather than the rule. The primary takeaway of the present research is that anthropomorphic products have the ability to affect the fulfillment of social needs—needs typically fulfilled by other people. Social need fulfillment via one route does not necessarily mean total exclusion of the other route; it simply means that once a need is fulfilled via one path a consumer may not immediately seek fulfillment of the need via the other path. More research on this topic is needed to identify when and why fulfillment of social needs via product consumption may come at a greater cost to genuine interpersonal interaction in some contexts or for certain consumer types compared to others. Furthermore, future research should explore the extent to which anthropomorphic products can influence specific social needs, and where interpersonal interaction and product interaction overlap and diverge with respect to social need fulfillment.

Another important contribution of the present research is that consumer products need not rely on tangible, anthropomorphic features to produce consequential effects. In other words, products do not necessarily need to *look* like people to fulfill social needs. For some individuals, physical anthropomorphism merely facilitates the process of deriving social benefits from material goods; it is not a necessary condition. For instance, a nonsocial object that serves to alleviate fear and encourage interaction among children is their security blanket. Passman and Weisberg (1975) reported that among blanket-attached toddlers, the blanket provides security and facilitates play exploration in a novel situation just as effectively as the mother's presence. In the absence of a loving caregiver, these children successfully directed their behavior toward an inanimate substitute object to derive the comfort they desired. Similar observations have been made among nonhuman primates, where a nonsocial object (i.e., a soft piece of terrycloth) provides comfort to infant monkeys raised without mothers (Harlow 1958).

Thus, what appears to matter are the social benefits derived from nonhuman material sources (e.g., consumer products); whether or not the objects appear physically anthropomorphic may be unnecessary. Indeed, in the current experiments, simply posing a question about a consumer product in a way that emphasizes the product's intangible anthropomorphic qualities was sufficient to elicit the effect. Marketing implications are plentiful, ranging from product descriptions (e.g., describing a product using lifelike descriptors like "a helpful assistant" and "friendly" as opposed to functional descriptors like "long battery life" and "portable") to advertising copy. The findings also suggest that explicitly anthropomorphic products do not fulfill social needs in the same way that subtly anthropomorphic products do (experiment 4), which has potential implications for product designs and descriptions.

Beyond advertising copy and product descriptions, implications of the current research extend to consumer contexts in which consumers are more or less likely to feel included or excluded. Indeed, the process of consumption itself can elicit feelings of social exclusion with those who "have" feeling more included and those who "do not have" feeling excluded. In fact, many marketing messages exploit social exclusion by making consumers feel like they are missing out, such as limited-time-offer promotions and invitation-only services (e.g., Ello social network). Other marketing tactics also rely on highlighting in-group versus out-group differences. Loyalty programs, including status programs for airlines, hotels, and credit cards, are an example of this. If a consumer feels excluded because he or she is not a member of the American Airlines AAdvantage program, a Starwood Preferred Guest, or the holder of an exclusive American Express "Black Card," might he or she then gravitate more toward anthropomorphic goods? The current findings suggest this may be the case, particularly at the moment of exclusion, but future research is needed to understand the limitations and boundary conditions for the phenomenon (e.g., the potential for longer-term consequences as a result of repeatedly using products to fulfill social needs).

Another idea worth exploring is when anthropomorphic attributes prime social needs versus fulfill social needs. Simply activating humanlike associations may be insufficient to satisfy social needs. Individual differences in perceived social connection may moderate priming or fulfilling effects. Even a factor like age could moderate effects, with younger people, having grown up in an era of anthropomorphic products, being more open to greater fluidity between interpersonal interaction and anthropomorphic products.

Real social relationships have become digitally mediated through technology, which in one sense has made it easier for individuals to connect across physical distance. In spite of this, people report never feeling more alone. The current research may shed light on the reason for this apparent contradiction by suggesting that too much reliance upon material objects to fulfill social needs may, paradoxically, compromise interpersonal relationships and does so at a subconscious level. While some have speculated about the role technology may play in decreasing interpersonal interaction (Turkle 2011), the current research suggests that *any* consumer product subtly construed as anthropomorphic could reduce interpersonal interactions, not just technological products. If consumers are able to fulfill social needs through products or other proxies (e.g., technology), they may approach a state of satiation whereby the motivation for interpersonal affiliation diminishes because social needs have already been satisfied. Similarly, the compensatory behaviors that socially excluded individuals often employ as a means of restoring social connection are no longer exhibited following engagement with an

anthropomorphic product. Thus, without being consciously aware of the process, socially isolated individuals may be thwarting the very behaviors that help restore social connection by interacting with anthropomorphic products. These ideas are worth exploring in future research.

As more consumer products—be it avatars, smart cars, or responsive technology—blur the line between product and person, understanding the consequences of anthropomorphic products in the marketplace is more critical than ever before. Although purely speculative at this point, our findings could provide some insight into why, in a time of unprecedented social connection from advances in technology and consumer products, individuals feel lonelier than ever before (Cacioppo and Patrick 2008). Our results suggest that anthropomorphic products may be—by mimicking the humanlike features to which socially excluded individuals are drawn—the very obstacles that derail typical compensatory behaviors designed to restore social connection. We hope the current research inspires future studies further exploring how consumer products and people fulfill innate social needs, sometimes at the expense of one another.

DATA COLLECTION INFORMATION

None of this work has been published or is under consideration for publication elsewhere. The first author collected data for experiments 2 (June and July 2016) and 3 (October 2012) using Amazon Mechanical Turk (MTurk). The second author conducted experiment 4 (September 2016) using MTurk and collected data for experiment 1 (October 2013) from an undergraduate student pool at the University of Michigan. The first and second authors conducted statistical analyses for all experiments under the supervision of the third author.

APPENDIX

PHONE QUESTION MANIPULATION (EXPERIMENTS 1 AND 3)

Anthropomorphized Phone Questions

1. *Design*. How would you rate the overall body and design of your phone (i.e., the body, weight, curves)?
2. *Sound*. How would you rate the voice quality of your phone? Does the phone play music well?
3. *Functionality*. How would you rate how well your phone does work? Does the phone perform tasks easily?
4. *Connectivity*. How would you rate how well your phone keeps you connected?

5. *User Interface*. How would you rate the user interface of your phone? Is the phone good at learning how you use it and then helping you?
6. *Camera*. How would you rate the quality of the phone's camera? Does your phone take good pictures?
7. *Apps*. How would you rate how well your phone runs applications?
8. *Battery Life*. How would you rate the quality of the phone's battery? Is your phone alive and vibrant or does it die easily and remain dull?
9. *Alarm*. How would you rate how well your phone wakes you up in the morning? How well does your phone notify you about upcoming appointments?
10. *Security*. How would you rate how well the phone both secures your information and makes you feel more secure by having it?

Nonanthropomorphized Phone Questions

1. *Design*. How would you rate the overall design of your phone (i.e., the case, the shape)?
2. *Sound*. How would you rate the sound of your phone (i.e., rings, audio)?
3. *Functionality*. How would you rate the functionality of your phone? Does it allow you to complete tasks easily?
4. *Connectivity*. How would you rate the connectivity of your phone? Does the antenna work well in receiving a signal?
5. *User Interface*. How would you rate the user interface of your phone (i.e., the main menu)? Is the design logical and straightforward?
6. *Camera*. How would you rate the quality of the phone's camera?
7. *Apps*. How would you rate how well applications (apps) run on the phone?
8. *Battery Life*. How would you rate the quality of the phone's battery?
9. *Alarm*. How would you rate the quality of the phone's alarm?
10. *Security*. How would you rate the security features of the phone?

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