

# When Green Products Come Alive: How Anthropomorphism Changes Warmth and Competence Perceptions of Green Products

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**Abstract:** Prior research suggests that anthropomorphism can enhance warmth and competence perceptions of certain products. However, whether green products are subject to enhancement in the two perceptions has not yet been examined. Through laboratory experiments using four different eco-friendly products, we showed a consistent boosting effect of anthropomorphism on perceived warmth, but the effect on competence is more nuanced. Competence was significantly enhanced for green products of which eco-friendliness is high, but not for products with comparatively neutral eco-friendliness. We suggest the reason is that anthropomorphism only enhances existing product features. Anthropomorphism consistently boosts the warmth of green products, since the presence of eco-friendly features entails the good intention of protecting the environment — a signal of warmth. In contrast, the differential competence boosting effect results from products' varying abilities to implement the intention of environmental protection reflected by different eco-friendliness levels, such that only highly eco-friendly products benefit from anthropomorphism regarding competence perceptions.

*Key Words: anthropomorphism, green products, warmth perception, competence perception.*

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## INTRODUCTION

As consumers reveal increasing concerns over environmental issues, companies pay more and more attention to demonstrating their sustainable commitments (Trudel & Cotte, 2009). One common practice is to introduce a product line that positions on eco-friendly attributes (i.e., green products; Haws et al., 2014). Recent examples include Adidas' revamp of *Stan Smith Running Shoes* as an entirely sustainable series, Tom Ford's first eco-friendly watch, *Ocean Plastic Timepiece*, made of ocean-derived plastics, and Gucci's *Off the Grid* collection emphasizing the recyclability of materials (Verry, 2021; Phelps, 2020; Farra, 2020).

Despite the prevalence of green products, research reported mixed findings regarding consumers' perception of the category. On the one hand, green products are associated with positive social images, such as altruism, helpfulness, and one's ability to afford costs (Griskevicius et al., 2010; Pelozo et al., 2013; Yan et al., 2021). On the other hand, consumers sometimes relate the category to low quality and poor functionality, since they suspect the resources of developing functional attributes are shifted to eco-friendly attributes (Lin & Chang, 2012; Luchs et al., 2010; Newman et al., 2014). Numerous measures have been proposed to enhance the positive perceptions while countering the negative ones, such as explicitly labeling quality information, and associating sustainable benefits with the firm rather than the product (Luchs et al., 2010; Chernev & Blair, 2021). However, rarely has research examined the effect of anthropomorphism, a commonly used marketing method that imbues humanlike features to non-living entities (Aggarwal & McGill, 2007; Epley, Waytz, Akalis & Cacioppo, 2008; Epley, Waytz & Cacioppo 2007).

The present research intends to fill the gap by investigating how anthropomorphism influences consumers' perceptions of green products from the perspectives of warmth and competence. Warmth and competence are two universal dimensions of interpersonal judgment, whereby warmth reflects traits related to intentions, while competence captures the ability to implement the intentions. (Fiske, Cuddy, Glick & Xu, 2002; Fiske, Cuddy & Glick, 2007). Building on this notion, we argue that when consumers judge green products in similar ways as they judge humans, the perceived warmth of products increases, but the perceived competence may not. Competence will be significantly boosted when green products have relatively high eco-friendliness, but not when their eco-friendliness is perceived to be relatively neutral. Based on Epley, Waytz, and Cacioppo (2007)'s research, we further propose that the consistent boosting of warmth and the differential competence enhancement occur because

anthropomorphism only boosts existing product characteristics. Since varying degrees of eco-friendliness all entail a good intention towards the environment (i.e., warmth), but indicate different abilities to act upon the intention (i.e., competence), anthropomorphism results in a consistent enhancement on warmth, not on competence. The next section takes a literature review of the theories upon which we developed our study.

## **THEORETICAL DEVELOPMENT**

### **Anthropomorphism**

Anthropomorphism refers to the attribution of human characteristics to nonhuman entities (Aggarwal & McGill, 2007; Epley, Waytz, Akalis & Cacioppo, 2008; Epley, Waytz & Cacioppo 2007). It is a specialized process where people apply self-knowledge as a basis of inductive inference for the characteristics of unknown entities (Epley, Waytz & Cacioppo, 2007). Based on the process, marketing literature demonstrates that the congruity between human schema and product features plays an important role in the evaluation of anthropomorphized entities, where consumers increase evaluation when the congruity is high (Aggarwal & McGill, 2007; Landwehr et al., 2011). For example, consumers show more favor to a car when it is anthropomorphized with a smile than when it is anthropomorphized with a frown, given that smiling is more congruent with human schema (Aggarwal & McGill, 2007).

More recent research finds that anthropomorphism goes beyond the physical resemblance between objects and human features. When interacting with an anthropomorphized agent, people also apply social belief to the entity, which, in turn, affects their judgments and decisions (Chandler & Schwarz, 2010; Kim & McGill, 2011; Waytz, et al., 2010; Zhou et al., 2019). For example, thinking objects as if they have human minds makes consumers less willing to make a replacement decision (Chandler & Schwarz, 2010). People with low status perceive more risk in engaging with anthropomorphized agents than people with high status (Kim & McGill, 2011). Going further, Zhou et al. theorize on mind perception in social psychology (Gray et al., 2007), showing that people evaluate anthropomorphized entities from the perspectives of warmth and competence, the two fundamental dimensions of interpersonal judgments (Fiske, Cuddy, Glick & Xu, 2002; Judd et al., 2005). They demonstrate that people perceive anthropomorphized money to be both warmer and more competent than money without humanlike features, and the increased warmth perception results in the important downstream consequence of encouraging donation.

While research discovers anthropomorphism's boosting effect on warmth and competence perceptions in some entities such as money, robots, and intelligent personal assistants (e.g., Hu et al., 2021; Stroessner & Benitez, 2019; Van Doorn et al., 2017, Zhou et al., 2019), the simultaneous increase is not captured by other objects (Chang et al., 2019; Kim et al., 2019; Li et al., 2019). For instance, using emoticons (i.e., depictions of humans' facial expressions) in a communal-oriented service relationship only increases the warmth of service providers, while using emoticons in an exchange-oriented relationship decreases competence but not warmth (Li et al., 2019). Such variation of perceptions across different anthropomorphized products is not entirely surprising, since warmth and competence also exhibit different correlations in judgments between humans under the Stereotype Content Model: the elderly are perceived to be less competent but warmer; the rich are considered competent but cold-blooded; the poor are regarded as both cold and incompetent, while the ingroup allies are both warm and competent (Cuddy et al., 2005; Fiske, Cuddy & Glick, 2007; Swencionis & Fiske, 2016; Judd et al., 2005). Hence, it is possible that anthropomorphism has different impacts on warmth and competence perceptions across different product categories.

Extending to current literature on consumer perceptions and anthropomorphism, this research takes a special focus on green products, examining how their perceived warmth and competence are affected by anthropomorphism. The following sections review research on green consumption and then form hypotheses.

### **Green Products**

Green consumption refers to consumers' choice of products with positive or less negative environmental impacts (Pickett-Baker & Ozaki, 2008; Young et al., 2010). Being viewed as a crucial part of prosocial behaviors that intends for others' benefits or even involves a forgo of personal benefits (Hardisty & Weber, 2009; Nolan & Schultz, 2015), one of the overarching themes of green literature lies in why consumers are motivated to purchase green products (Bamberg & Möser, 2007; White, Habib & Hardisty, 2019). This line of research identifies important factors linked to social images and one's self-concept, where green consumption makes the positive impression of warmth, altruism and helpfulness on others and the self (Mazar & Zhong, 2010; Olson et al., 2016). For example, Yan et al.'s (2021) research finds that sustainable consumption helps low-class consumers better assimilate into a group. Also, a sustainable practice allows consumers to reaffirm their moral identity, especially when their moral self is threatened by a recent transgression (Aquino et al., 2009). In this regard, green consumption is highly related to warmth in self-concept and interpersonal judgment.

However, the association between green products and competence perceptions is more nuanced. In some contexts, green products can suggest high competence by indicating one's status, wealth, and ability (Elliott, 2013; Griskevicius et al., 2010; Sexton & Sexton, 2014). Since green products usually have a higher price than regular products, they serve as a communicative signal that the buyers can afford additional costs (Griskevicius et al., 2010). In fact, for high-status consumers, purchasing green products is one of their ways to differentiate themselves from other classes (Yan. et al., 2021). From another perspective, continuously performing sustainable behaviors can also represent the self-efficacy of consumers who are confident that their sustainable consumption can bring significant impacts (Peattie, 2001; White, MacDonnell & Dahl, 2011).

In other contexts, however, green products are associated with low effectiveness, poor performance, and incompetence (Lin & Chang, 2012; Luchs et al., 2010; Newman et al., 2014). For instance, consumers use a significantly larger amount of eco-friendly laundry than regular laundry in a single instance due to the belief that green products are less effective (Luchs et al., 2010). They also perceive green products to have even lower quality when firms deliberately accentuate green attributes (Newman et al., 2014). Moreover, green products are less favored when consumers look for strength-related attributes (Lin & Chang, 2012), and when males perceive a threat to their masculine identity caused by the green-femininity association (Brough et al., 2016). Hence, while green products are related to the image of high warmth, their association with competence is less clear and might depend on specific contexts or product characteristics.

### **The Anthropomorphism of Green Products**

How does anthropomorphism affect warmth and competence perceptions of green products, a category related to high warmth, but differential levels of competence? We propose that congruent with their innate characteristics, anthropomorphism boosts perceived warmth, while not necessarily enhancing perceived competence. The competence perception of a green product is more likely to increase by anthropomorphism when it is perceived to be highly eco-friendly, but not when its eco-friendliness is relatively neutral.

The prediction is in line with prior research, which suggests product nature affects how anthropomorphism changes one's judgments (Aggarwal & McGill, 2007; Burgoon et al., 2000; Epley, Waytz, & Cacioppo; 2007; Puzakova et al., 2013). Specifically, Epley, Waytz, and Cacioppo decomposes anthropomorphism process into three stages, namely, 1) the activation of human schema for the inferences of objects' properties, 2) the adjustment to existing

knowledge about objects based on their anthropomorphic representations, and 3) the application of adjusted representations to perceptions and judgments. As the process involves an integration of one's existing knowledge about an object, judging an anthropomorphized entity entails the understanding of its non-anthropomorphized version. Indeed, research has demonstrated that anthropomorphism increases evaluation for products with positive qualities, while the evaluation becomes worse for entities with negative characteristics (Aggarwal & McGill, 2007; Burgoon et al., 2000; Puzakova et al., 2013). For instance, when a brand suffers from negative publicity due to products' wrongdoings, consumers decrease the evaluation for an anthropomorphized brand to a larger extent than for a non-anthropomorphized brand (Puzakova et al., 2013). Hence, we propose that anthropomorphism may only be able to act on products' existing features.

When it comes to green products, we suggest eco-friendliness to be a signal of their innate warmth and competence. According to the Stereotype Content Model, warmth and competence correspond to intentions and capabilities, respectively (Abele & Wojciszke, 2014; Fiske, Cuddy, Glick & Xu, 2002). That is, traits related to warmth, such as friendliness, helpfulness, and morality, reflect one's intents and are concerned with valence in judgments (i.e., whether the intention is good or bad; Fiske, Cuddy & Glick, 2007; Wojciszke, et al., 1993). In comparison, traits related to competence, such as intelligence, skills, and efficacy, capture the ability to act upon intents and predicts extents (i.e., how well or how badly the intention is implemented; Fiske, Cuddy & Glick, 2007; Wojciszke, et al., 1993).

The eco-friendliness feature itself entails the good intention of being "nice," "friendly," and "helpful" to the environment, which is a signal of warmth. In fact, the close association between warmth and eco-friendliness is implied by prior research, which suggests green products are associated with feminine images, and feminine images are related to warmth (Brough et al., 2016; Ellemers, 2018; Huddy & Terkildsen, 1993; Rudman et al., 2001). Due to the innate warm intention of eco-friendliness, anthropomorphism is likely to enhance the warmth perception of green products.

However, how well the intention of environmental protection can be fulfilled is a question of extent, which is associated with competence. We argue that green products' competence of benefiting the environment is reflected by the degree of perceived eco-friendliness. Prior research shows that not all green products have the same level of eco-friendliness (Gershoff & Frels, 2015; Magnier et al., 2015; Medeiros & Ribeiro, 2017). Even with the same sustainable claim, consumers perceive a product to be more eco-friendly when

the claim is about its central attribute than when it is about a peripheral attribute (Gershoff & Frels, 2015). As the perceived ability to protect the environment differs across products, it follows that the strength of anthropomorphism enhancement on competence also varies. Only when consumers consider a product to be highly eco-friendly in nature can it significantly benefit from anthropomorphism in terms of competence perceptions.

## **METHODS**

### **Participants and Design**

We tested our hypothesis that anthropomorphism increases perceived warmth but does not necessarily enhance perceived competence of green products in four experiments with a total of 809 participants recruited from Amazon Mechanism Turk (MTurk) (50.8% female,  $M_{\text{age}} = 41.24$ ,  $SD_{\text{age}} = 12.12$ ). Since all studies have similar two-factor between-subjects designs (anthropomorphism vs. non-anthropomorphism; green product vs. regular product) using different stimuli (i.e., corkscrew, lamp, cup, and plant pot), we combined them all and reported them as one study for a more holistic analysis. Each participant was randomly assigned to one of the conditions. They were first instructed to complete an anthropomorphism task and then proceeded to questions regarding product perceptions, manipulation checks, controlled variables, and demographic information.

### **Anthropomorphism Manipulation**

We adapted the method of anthropomorphism manipulation from Aggarwal and McGill (2012), Zhou et al., and Chandler and Schwarz (2010). In the anthropomorphism conditions, participants were presented with an advertisement in which the product was endowed with facial expressions or gestures that resembled human features. To strengthen the manipulation, participants were asked to imagine the product coming alive and describe the personality of that product, such as whether he/she is shy or outgoing, cooperative, or uncooperative, adventurous or conservative, etc. In contrast, those in the non-anthropomorphized conditions viewed an advertisement of a product without humanized features and were asked to describe the physical features of the product, such as its size, texture, material, etc. We used real-life products for all stimuli in the anthropomorphized conditions, and two groups (i.e., corkscrew and lamp) in the non-anthropomorphized conditions to achieve high external validity. In comparison, we increased the internal validity of the rest two groups (i.e., cup and plant pot) by erasing their humanized features for the non-anthropomorphized versions (see appendix).

## **Eco-friendliness Manipulation**

We manipulated the perceived eco-friendliness of products by providing additional information about their materials. In the green conditions, product materials were framed to be resource-saving in their production or biodegradable at their disposal. In the regular conditions, participants viewed an ad that included the same product attributes as the green conditions, except that no information about eco-friendly materials was given (see appendix). To avoid co-founders, all eco-friendly messages did not imply additional personal benefits, and thus, messages in the two conditions only varied in terms of environmental benefits.

## **Measures**

After completing the anthropomorphism task, participants indicated their warmth and competence perceptions of the product by answering to what extent several descriptors described the product they saw (1 = not at all, 7 = very much). The descriptors about warmth and competence were adapted from Aaker et al. (2010), and Fiske, Cuddy, Glick & Xu (2007; warmth: kind, generous, friendly, warm, nice; competence: competent, efficient, effective, intelligent, skillful), and were presented with a randomized order.

Then, participants completed items regarding manipulation checks. Specifically, we checked the manipulation of anthropomorphism based on Waytz, Cacioppo et al. (2010)'s anthropomorphism scale (i.e., to what extent do you think the product 1) is like a person; 2) can experience emotion; 3) has a mind of its own; 4) has its own will and 5) has intentions of its own; 1 = not at all, 7 = very much). For the manipulation check of eco-friendliness, we asked participants to rate the extent to which they regarded the product as eco-friendly on a 7-point Likert scale (i.e., "The \_\_\_ is eco-friendly", "The \_\_\_ is NOT an environmental-friendly product<sup>1</sup>", and "The\_\_\_ has been designed to reduce harm to the environment"; 1 = not at all, 7 = very much).

## **RESULTS**

Participants who failed to pass attention checks were excluded, which leaves 698 participants (51.0% female,  $M_{age} = 41.91$ ,  $SD_{age} = 12.26$ ) for data analyses.

### **Manipulation Checks**

We averaged the scores of five items regarding anthropomorphism ( $\alpha = .950$ ). A 2 (anthropomorphism)  $\times$  2 (eco-friendliness)  $\times$  4 (product) ANOVA revealed a significant main

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<sup>1</sup> The second item of eco-friendliness manipulation check is reverse-coded, where high scores indicates low eco-friendly perceptions.



effect of anthropomorphism ( $F(15, 682) = 158.775, p < .001, \eta^2 = .189$ ), whereby products in the anthropomorphism groups ( $M = 2.74, SD = 1.80$ ) were perceived to be more humanlike than those in the non-anthropomorphism groups ( $M = 1.39, SD = .96$ ). All other effects were not significant (all  $ps > .05^2$ ). Hence, the manipulation of anthropomorphism was successful.

We recoded the reverse-scored item in the eco-friendliness measurement and averaged its score with the other two items ( $\alpha = .952$ ). A 2 (anthropomorphism)  $\times$  2 (eco-friendliness)  $\times$  4 (product) ANOVA revealed a significant main effect of eco-friendliness ( $F(15, 682) = 1025.886, p < .001, \eta^2 = .601$ ). Products in the green conditions ( $M = 6.44, SD = .80$ ) were perceived to be more eco-friendly than those in the regular conditions ( $M = 3.74, SD = 1.39$ ). In addition, we also discovered a significant main effect of product on eco-friendliness scores ( $F(15, 682) = 12.860, p < .001, \eta^2 = .054$ ), indicating that the extent of eco-friendliness varied across different products. All other effects were not significant (all  $ps > .05^3$ ). Therefore, the manipulation of eco-friendliness was successful.

### Warmth Perception

Five items measuring warmth were averaged to a composite score ( $\alpha = .962$ ). A 2 (anthropomorphism)  $\times$  2 (eco-friendliness)  $\times$  4 (product) ANOVA on the composite score showed a significant main effect of anthropomorphism ( $F(15, 682) = 134.205, p < .001, \eta^2 = .164$ ) and product type ( $F(15, 682) = 2.713, p = .044, \eta^2 = .012$ ) on warmth perceptions, whereas all other effects were not significant (all  $ps > .05^4$ ). Participants perceived anthropomorphized products ( $M = 5.25, SD = 1.66$ ) to be warmer than non-anthropomorphized products ( $M = 3.71, SD = 1.83$ ), although basic level of warmth was different for different products.

We then performed 2 (anthropomorphism)  $\times$  2 (eco-friendliness) ANOVA for each product, and obtained the consistent main effect of anthropomorphism on warmth perceptions across the plant pot ( $F(3, 169) = 16.446, p < .001, \eta^2 = .089$ ), cup ( $F(3, 167) = 52.075, p < .001, \eta^2 = .238$ ), corkscrew ( $F(3, 171) = 37.951, p < .001, \eta^2 = .182$ ), and lamp ( $F(3, 175) = 32.448, p < .001, \eta^2 = .156$ ). Furthermore, planned contrasts for individual products consistently demonstrated that the anthropomorphized groups had higher warmth scores than

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<sup>2</sup> There were marginally significant main effect of product ( $F(15, 682) = 2.359, p = .070, \eta^2 = .010$ ), and interaction effect between products and anthropomorphism ( $F(15, 682) = 2.278, p = .078, \eta^2 = .010$ ).

<sup>3</sup> There were marginally significant main effect of anthropomorphism ( $F(15, 682) = 2.927, p = .088, \eta^2 = .004$ ), and interaction effect between products and eco-friendliness ( $F(15, 682) = 2.484, p = .060, \eta^2 = .011$ ).

<sup>4</sup> There was a marginally significant main effect of eco-friendliness ( $F(15, 682) = 3.193, p = .074, \eta^2 = .005$ ).

the non-anthropomorphized group in both green and regular conditions, as summarized in Tables 1 and 2.

**Table 1**

*Descriptive Statistics of Perceived Warmth across Different Products*

	Anthro Green	Non-Anthro Green	Anthro Regular	Non-Anthro Regular
Plant Pot	5.47 (1.33)	4.20 (2.00)	5.02 (1.78)	4.13 (1.79)
Cup	5.67 (1.61)	3.65 (1.93)	5.43 (1.61)	3.52 (1.86)
Lamp	5.37 (1.56)	3.75 (1.70)	5.04 (1.86)	3.74 (1.66)
Corkscrew	5.04 (1.54)	3.67 (1.92)	4.99 (1.89)	3.06 (1.65)

*Note.* Participants rated perceived warmth on a 7-point scale. Higher values indicated greater perceived warmth. Standard deviations were included in parentheses.

**Table 2**

*Contrasts of Perceived Warmth between the Anthropomorphism and Non-Anthropomorphism Groups across Different Products*

Condition	Product	<i>t</i> -stats	<i>p</i> -value	Effect size	[CIL, CIH]
Green	Plant Pot	$t(169) = 3.426$	.001	.742	[.309, .1.170]
	Cup	$t(167) = 5.325$	< .001	1.119	[.666, .1.567]
	Lamp	$t(175) = 4.441$	< .001	.983	[.536, .1.425]
	Corkscrew	$t(171) = 3.554$	< .001	.782	[.334, 1.226]
Regular	Plant Pot	$t(169) = 2.326$	.021	.498	[.062, .932]
	Cup	$t(167) = 4.889$	< .001	1.100	[.632, .1.562]
	Lamp	$t(175) = 3.612$	< .001	.744	[.311, 1.174]
	Corkscrew	$t(171) = 5.197$	< .001	1.087	[.643, 1.525]

*Note.* Effect size = Cohen's *d*. CIL = lower bounds for 95% confidence intervals. CIH = higher bounds of 95% confidence intervals.

**Competence Perception**

We averaged five items regarding competence to form a composite measure ( $\alpha = .898$ ) and performed a 2 (anthropomorphism)  $\times$  2 (eco-friendliness)  $\times$  4 (product) ANOVA on it. Results showed a significant main effect of anthropomorphism ( $F(15, 682) = 30.476, p < .001, \eta^2 = .043$ ), and product ( $F(15, 682) = 4.411, p = .004, \eta^2 = .019$ ) on competence perceptions, whereas all other effects were not significant (all  $ps > .05^5$ ). In general, participants perceived

<sup>5</sup> There was a marginally significant main effect of eco-friendliness ( $F(15, 682) = 3.725, p = .054, \eta^2 = .005$ ).

anthropomorphized products to be more competent ( $M = 5.37$ ,  $SD = 1.40$ ) than non-anthropomorphized products ( $M = 4.77$ ,  $SD = 1.45$ ).

We then performed 2 (anthropomorphism)  $\times$  2 (eco-friendliness) ANOVA for each product. While the main effect of anthropomorphism was consistently shown for the cup ( $F(3, 167) = 9.958, p = .002, \eta^2 = .056$ ), plant pot ( $F(3, 169) = 5.084, p = .025, \eta^2 = .029$ ), corkscrew ( $F(3, 171) = 12.792, p < .001, \eta^2 = .07$ ), and lamp ( $F(39, 175) = 4.345, p = .039, \eta^2 = .024$ ), planned contrasts revealed that green products and regular products reacted to anthropomorphism differently. Across four products, the anthropomorphized plant pot ( $M = 5.69$ ,  $SD = 1.03$ ), cup ( $M = 5.35$ ,  $SD = 1.56$ ), and lamp ( $M = 5.54$ ,  $SD = 1.28$ ) were perceived to be more competent than their non-anthropomorphized versions ( $M_{pot} = 4.84$ ,  $SD_{pot} = 1.46$ ;  $M_{cup} = 4.37$ ,  $SD_{cup} = 1.65$ ;  $M_{lamp} = 5.57$ ,  $SD_{lamp} = 1.14$ ) only in the green conditions ( $t(169)_{pot} = 3.120, p_{pot} = .002, d_{pot} = .665$ ;  $t(167)_{cup} = 2.834, p_{cup} = .005, d_{cup} = .608$ ;  $t(175)_{lamp} = 2.067, p_{lamp} = .040, d_{lamp} = .475$ ), but not in the regular conditions ( $t(169)_{pot} = .112, p_{pot} = .911, d_{pot} = .024$ ;  $t(167)_{cup} = 1.650, p_{cup} = .101, d_{cup} = .362$ ;  $t(175)_{lamp} = .877, p_{lamp} = .382, d_{lamp} = .175$ ). In contrast, the anthropomorphized corkscrew ( $M = 5.67$ ,  $SD = 1.21$ ) had a significantly higher competence score than its non-anthropomorphized version in the regular condition ( $M = 4.76$ ,  $SD = 1.37$ ;  $t(171) = 3.417, p = .001, d = .374$ ), but the difference was only marginally significant in the green condition ( $t(171) = 1.680, p = .095, d = .707$ ).

**Table 3**

*Descriptive Statistics of Perceived Competence across Different Products*

	Anthro Green	Non-Anthro Green	Anthro Regular	Non-Anthro Regular
Plant Pot	5.69 (1.03)	4.84 (1.46)	5.05 (1.49)	5.01 (1.06)
Cup	5.35 (1.56)	4.37 (1.65)	4.93 (1.58)	4.34 (1.67)
Lamp	5.54 (1.28)	4.90 (1.40)	5.11 (1.64)	4.84 (1.46)
Corkscrew	5.58 (1.14)	5.11 (1.35)	5.67 (1.21)	4.76 (1.37)

*Note.* Participants rated perceived competence on a 7-point scale. Higher values indicate greater perceived competence. Standard deviations were included in parentheses.

**Table 4**

*Contrasts of Perceived Competence between the Anthropomorphism and Non-Anthropomorphism Groups across Different Products*

Condition	Product	<i>t</i> -stats	<i>p</i> -value	Effect size	[CIL, CIH]
Green	Plant Pot	$t(169) = 3.120$	.002	.665	[.235, .1.091]
	Cup	$t(167) = 2.834$	.005	.608	[.178, .1.035]

	Lamp	$t(175) = 2.067$	.040	.475	[.048, .900]
	Corkscrew	$t(171) = 1.680$	.095	.374	[-.060, .807]
	Plant Pot	$t(169) = .112$	.911	.024	[-.404, .453]
Regular	Cup	$t(167) = 1.650$	.101	.362	[-.075, .798]
	Lamp	$t(175) = .877$	.382	.175	[-.243, .592]
	Corkscrew	$t(171) = 3.417$	.001	.707	[.281, 1.129]

*Note.* Effect size = Cohen's *d*. CIL = lower bounds for 95% confidence intervals. CIH = higher bounds of 95% confidence intervals.

### Product Type and Eco-Friendly Perception

Following the main effect of product on eco-friendliness perceptions found in the manipulation check, we further conducted planned contrasts across products. When products were given green messages, their eco-friendliness levels were boosted to different extents. The cup ( $M = 6.60$ ,  $SD = .62$ ;  $t(690) = 1.991$ ,  $p = .047$ ,  $d = .423$ ), plant pot ( $M = 6.57$ ,  $SD = .78$ ;  $t(690) = 1.857$ ,  $p = .064$ ,  $d = .364$ ), and lamp ( $M = 6.34$ ,  $SD = .82$ ;  $t(690) = .450$ ,  $p = .653$ ,  $d = .086$ ) were perceived to be more eco-friendly than the corkscrew ( $M = 6.26$ ,  $SD = .93$ ), although lamp's perceived competence was directionally but not significantly higher than that of the corkscrew. In addition, between the eco-friendly cup, plant pot, and lamp, there was no significant difference in their perceived eco-friendliness ( $t(690)_{\text{pot-cup}} = .136$ ,  $p_{\text{pot-cup}} = .892$ ,  $d_{\text{pot-cup}} = .032$ ;  $t(690)_{\text{pot-lamp}} = 1.433$ ,  $p_{\text{pot-lamp}} = .152$ ,  $d_{\text{pot-lamp}} = .295$ ;  $t(690)_{\text{cup-lamp}} = 1.570$ ,  $p_{\text{cup-lamp}} = .117$ ,  $d_{\text{cup-lamp}} = .353$ ). The pattern was consistent with the extent to which competence was boosted by anthropomorphism in the green conditions, where the anthropomorphized cup and pots experienced the most significant increase, followed by the lamp, and then by the corkscrew.

In contrast, when eco-friendly messages were hidden from participants, the corkscrew ( $M = 3.23$ ,  $SD = 1.23$ ) was perceived to be significantly less eco-friendly than the pot ( $M = 4.15$ ,  $SD = 1.44$ ;  $t(690) = -5.524$ ,  $p < .001$ ,  $d = .692$ ), cup ( $M = 4.05$ ,  $SD = 1.35$ ;  $t(690) = -4.924$ ,  $p < .001$ ,  $d = .640$ ), and lamp ( $M = 3.57$ ,  $SD = 1.35$ ;  $t(690) = -2.084$ ,  $p = .038$ ,  $d = .265$ ). Moreover, the lamp was perceived to be significantly less eco-friendly than the pot ( $t(690) = -3.471$ ,  $p = .001$ ,  $d = .417$ ) and cup ( $t(690) = -2.868$ ,  $p = .004$ ,  $d = .357$ ), while no difference was found between the cup and pot ( $t(690) = -.573$ ,  $p = .567$ ,  $d = .07$ ). The pattern was the reverse of competence boosting pattern of regular products, where the anthropomorphized lamp enjoyed the most significant enhancement, followed by the lamp, and then by the cup and plant pot.

## DISCUSSION

Anthropomorphism has been widely applied to market different types of products, yet how it affects green products has not been systematically examined. This research filled in the gap by investigating anthropomorphism's effect on the warmth and competence of green products. We demonstrated convergent evidence that anthropomorphism increased the perceived warmth of green products and replicated prior work by showing the boosting effect of warmth for comparably non-green products. However, the effect of anthropomorphism was more nuanced regarding competence perceptions. Competence of green products was significantly boosted when their greenness was relatively high, but not when products had relatively neutral eco-friendliness. The findings implied that the boosting effect of anthropomorphism might only act on existing product features. Since varying degrees of eco-friendliness all entail a good intention towards the environment (i.e., warmth), but indicate different abilities to act upon the intention (i.e., competence), anthropomorphism results in a consistent enhancement on warmth, but only products with high eco-friendliness scores are enhanced competence significantly.

### **Theoretical Implications**

Our findings add to the knowledge of anthropomorphism regarding how it affects consumer perceptions. Consumers tend to perceive anthropomorphized entities in a similar way as they judge human beings in the interpersonal setting. Based on the mind perception theory, prior research demonstrates an increase in warmth and/or competence perceptions of anthropomorphized entities, such as money (Zhou et al., 2019), robots (Stroessner & Benitez, 2019), vehicles (Chandler & Schwarz, 2012; Waytz, Heafner, et al., 2014), and disease (Kim & McGill, 2011). Extending this line of research, we focus on the special category of green products that are associated with high warmth but mixed valence of competence. We provide new insights that anthropomorphism significantly boosts warmth perceptions, but the extent of competence enhancement is related to their perceived capability of environment protection. The results echo Epley, Waytz, and Cacioppo's three-stage account of anthropomorphism process, and show evidence that anthropomorphism may only boost existing product features instead of creating new product characteristics.

The research also contributes to the literature on how anthropomorphism affects socially responsible behaviors. When discussing the humanization of prosocial stimuli, prior research has mostly focused on aspects related to warmth. For instance, Tam et al. (2013) show

that anthropomorphizing nature results in the sense of connectedness to the earth; Ahn et al. (2014) find that anthropomorphism increases compliance with social causes through the feeling of anticipatory guilt; and Ketron and Naletelich (2019) discover that an anthropomorphic messenger could elicit one's feelings of sympathy, which increases sustainable behaviors. Our research, however, additionally takes competence into consideration, and shifts the discussion from more communal-related conservation into a more exchange-related purchasing context. We complement the existing studies by showing the conditional boosting of green products' competence, a perception that may be more important in exchange-relationship than warmth (Aaker et al., 2010; Grandey et al., 2005).

### **Managerial Implications**

The current research provides crucial implications for marketing environmental-friendly products. Prior literature warns against the practice of intentionally positioning on green attributes, as it may create an incompetent perception of the product (Newman et al., 2014). However, this research demonstrates the possibility of countering such a perception by the simple technique of imbuing humanlike features to the product. It opens an avenue for firms to explicitly communicate their sustainable commitment through product characteristics without suffering from low-competence inferences. Moreover, since persuading consumers that a product is highly eco-friendly is the first to have the competence boosting effect, our results provide the important guidance that firms should ensure sufficient efforts in delivering eco-friendly messages when using the anthropomorphism technique.

### **Limitations and Future Research**

While our study systematically tested the anthropomorphism effect on warmth and competence perceptions of green products, future research can enrich our findings from several perspectives. First, in analyzing competence perceptions of regular products, we obtained an inverse pattern of eco-friendliness scores and the extent to which competence was enhanced. That is, competence perceptions of regular products were significantly boosted when the products were less environmental-friendly. While eco-friendliness may not be an indicator of regular products' competency, future research could explore why the exact reverse pattern was discovered. One possible account is related to their perceived functionality. Since prior research shows that consumers tend to perceive regular products to function more effectively than green products (e.g., Luchs et al., 2010), regular products with relatively lower eco-friendliness scores might be regarded as better in functionality — an indicator of higher competence. Since the current research did not distinguish the competency of protecting the

environment from the competency of functioning well, future research could conduct studies to differentiate the two types.

Second, although this research discovered a consistent pattern that higher eco-friendliness scores correspond to a larger extent of competence enhancement by anthropomorphism, the difference in eco-friendliness between the lamp and corkscrew was only directional but not significant. This can be related to the study method in which we relied on products' individual differences in eco-friendliness, and the sample size per condition was relatively small. Future research can enlarge the sample size and directly manipulate the eco-friendliness to different levels (i.e., highly eco-friend, moderately eco-friendly, neutral eco-friendly) to test their correspondence with competence enhancement. This could be a more direct measure of the proposed mechanism that anthropomorphism boosts existing features of a product rather than creating a new characteristic.

Going further, future research could test the boosting mechanism with a different product category using dimensions other than warmth and competence. For instance, prior research demonstrates that people prefer anthropomorphized products with superior appearance due to the activation of the “beauty-is-good” belief (Wan et al., 2017), yet it is unclear how anthropomorphism may influence aesthetics for good-looking products and products with neutral appearances. Following the logic that anthropomorphism may boost existing features, researchers could test whether consumers perceive a better appearance only for anthropomorphized products with superior aesthetics.

Additionally, future research could also examine the actional moderators along with downstream consequences of perceptual changes brought by anthropomorphism. Our study also included the measures of consumers' willingness to pay, but we only found a significant increase in the anthropomorphized plant cup ( $t(161) = 3.618, p < .001, d = .788$ ) among four different products. The result may be because we did not distinguish potential moderators, such as the relationship norm (communal vs. exchange) that affects how perceived warmth and competence change consumer attitudes (Aggarwal, 2004, Scott et al., 2013; Li et al., 2019). Future research could take moderators into consideration to detect any interaction effect of anthropomorphism on consumer preference for green products.

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## APPENDIX

### 1. Cup

#### (a) anthropomorphized green products



#### **I Am An Eco-Friendly Cup**

**Eco-Friendly:** Made of porcelain, which is highly friendly to the environment throughout the life cycle. No plastics, cadmium or lead are included

**Safe to Use:** 100% dishwasher safe, microwave safe and freezer safe

**Easy to Clean:** Resist sticking, which makes it easy to clean with soap and water

#### (b) non-anthropomorphized green products



#### **An Eco-Friendly Cup**

**Eco-Friendly:** Made of porcelain, which is highly friendly to the environment throughout the life cycle. No plastics, cadmium or lead are included

**Safe to Use:** 100% dishwasher safe, microwave safe and freezer safe

**Easy to Clean:** Resist sticking, which makes it easy to clean with soap and water

#### (c) anthropomorphized regular products



#### **I Am A Cup**

**Safe to Use:** 100% dishwasher safe, microwave safe and freezer safe

**Easy to Clean:** Resist sticking, which makes it easy to clean with soap and water

(d) non-anthropomorphized regular products

## Cup



**Safe to Use:** 100% dishwasher safe, microwave safe and freezer safe

**Easy to Clean:** Resist sticking, which makes it easy to clean with soap and water

## 2. Plant Pot

(a) anthropomorphized green products

### Eco-friendly Plant Pot



**Eco Friendly:** made of clay and fiber materials, which are 100% biodegradable and do zero harm to the environment. If you want to add some natural, plastic free charm into your home, this plant pot is the perfect choice.

#### **Lightweight:**

a brilliant alternative to regular heavy ceramic pots, making your plant easy to carry

#### **Drainage Hole:**

include four drainage holes at the bottom with removable plugs to avoid stagnant water and help the plant stay healthy.

(b) non-anthropomorphized green products

## Eco-friendly Plant Pot



**Eco Friendly:** made of clay and fiber materials, which are 100% biodegradable and do zero harm to the environment. If you want to add some natural, plastic free charm into your home, this plant pot is the perfect choice.

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a brilliant alternative to regular heavy ceramic pots, making your plant easy to carry

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(c) anthropomorphized regular products

## Plant Pot



### Lightweight:

a brilliant alternative to regular heavy ceramic pots, making your plant easy to carry

### Drainage Hole:

include four drainage holes at the bottom with removable plugs to avoid stagnant water and help the plant stay healthy.

(d) non-anthropomorphized regular products

## Plant Pot



### Lightweight:

a brilliant alternative to regular heavy ceramic pots, making your plant easy to carry

### Drainage Hole:

include four drainage holes at the bottom with removable plugs to avoid stagnant water and help the plant stay healthy.

## 3. Lamp

(a) anthropomorphized green products

## Eco-friendly Desk Lamp

### Eco-Friendly

Use PLA plastics for the lampshade. Producing PLA plastics needs 65% less energy than producing conventional plastics.

### Highly Flexible

Easily adjust the reading light to your desired direction by rotating the lamp head.

### Universal USB

Equipped with universal USB charging cable. Allow you to charge with USB adapter, power bank, desktop, laptop while lighting it up.





(b) non-anthropomorphized green products

## Eco-friendly Desk Lamp

### Eco-Friendly

Use PLA plastics for the lampshade. Producing PLA plastics needs 65% less energy than producing conventional plastics.

### Highly Flexible

Easily adjust the reading light to your desired direction by rotating the lamp head.

### Universal USB

Equipped with universal USB charging cable. Allow you to charge with USB adapter, power bank, desktop, laptop while lighting it up.



(c) anthropomorphized regular products

## Desk Lamp

### Highly Flexible

Easily adjust the reading light to your desired direction by rotating the lamp head.

### Universal USB

Equipped with universal USB charging cable. Allow you to charge with USB adapter, power bank, desktop, laptop while lighting it up.



(d) non-anthropomorphized regular products

## Desk Lamp

### Highly Flexible

Easily adjust the reading light to your desired direction by rotating the lamp head.

### Universal USB

Equipped with universal USB charging cable. Allow you to charge with USB adapter, power bank, desktop, laptop while lighting it up.



#### 4. Corkscrew

##### (a) anthropomorphized green products



### Wine Corkscrew

#### Eco-Friendly

Steel + highly sustainable RPET plastic that takes less energy to produce

#### Easy to Use

simply twist the handle and press the wings down to extract the cork

#### Highly Convenient

small size and light weight, easy to carry for outdoor use

#### Product Warranty

unconditional free replacement or full refund if problems occur



##### (b) non-anthropomorphized green products



### Wine Corkscrew

#### Eco-Friendly

Steel + highly sustainable RPET plastic that takes less energy to produce

#### Easy to Use

simply twist the handle and press the wings down to extract the cork

#### Highly Convenient

small size and light weight, easy to carry for outdoor use

#### Product Warranty

unconditional free replacement or full refund if problems occur



##### (c) anthropomorphized regular products



### Wine Corkscrew

#### Easy to Use

simply twist the handle and press the wings down to extract the cork

#### Highly Convenient

small size and light weight, easy to carry for outdoor use

#### Product Warranty

unconditional free replacement or full refund if problems occur



(d) non-anthropomorphized regular products



## Wine Corkscrew

### Easy to Use

simply twist the handle and press the wings down to extract the cork

### Highly Convenient

small size and light weight, easy to carry for outdoor use

### Product Warranty

unconditional free replacement or full refund if problems occur

