The Influence of Product Anthropomorphism on Comparative Judgment

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The present research proposes a new perspective to investigate the effect of product anthropomorphism on consumers' comparative judgment strategy in comparing two anthropomorphized (vs. two nonanthropomorphized) product options in a consideration set. Six experiments show that anthropomorphism increases consumers' use of an absolute judgment strategy (vs. a dimension-by-dimension strategy) in comparative judgment, leading to increased preference for the option with a more favorable overall evaluation over the option with a greater number of superior dimensions. The effect is mediated by consumers' perception of each anthropomorphized product alternative as an integrated entity rather than a bundle of separate attributes. The authors find the effect to be robust by directly tracing the process of participants' information processing using MouseLab software and eye-tracking techniques, and by self-reported preferences and real consumption choices. Moreover, the effect is moderated by the motivation to seek maximized accuracy or ease. These studies have important implications for theories about anthropomorphism and comparative judgment as well as marketing practice.

Keywords: anthropomorphism, comparative judgment, absolute strategy, dimension-by-dimension strategy

Product anthropomorphism, or imbuing products with human-like characteristics, has been widely used in marketing practice (Aggarwal and McGill 2017; Kim, Chen, and Zhang 2016). Marketers may design an anthropomorphized visual representation of the product with human physical features (e.g., Jean Paul Gaultier designs perfume bottles with human body shapes), verbally describe the product in humanized terms (e.g., Nikon uses first-person language, "I am the D3100," to introduce a digital camera), or create a mascot to represent a brand (e.g., the Michelin Man speaks for the brand).

As product anthropomorphism becomes an increasingly popular marketing tactic among various types of firms, it becomes more and more common for consumers to encounter situations in which they directly compare two anthropomorphized products in the same category. For example, after Jean Paul Gaultier created the perfume Classique with a human body–shaped bottle in 1993, Anna Sui introduced the perfume Dolly Girl with a female human-like design in 2003, followed by Gwen Stefani, who launched Harajuku Lovers with a similar humanized design in 2008. Likewise, both Tohato and Chips Ahoy

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humanize their cookie products in marketing communications, and Energizer and Panasonic both include a "battery man" in their battery product packages and advertising. Such comparisons of anthropomorphized products in the same category occur not only in the traditional marketplace (e.g., supermarkets and shopping malls) but also on online shopping platforms, which provide consumers with opportunities to compare such product offerings conveniently. In these situations, product anthropomorphism might have unintended consequences of which practitioners are not fully aware. In situations involving comparisons among anthropomorphized products, the effects of anthropomorphism may go over and above its established effects on the judgment of each individual product, which has been the primary focus of previous literature (for a recent review, see Aggarwal and McGill 2017). The current research aims to fill this gap by identifying the unique consequences of anthropomorphism in this important context of comparing anthropomorphized product alternatives.

When considering product alternatives simultaneously, consumers often adopt different comparative judgment strategies in their decision making (Hsee et al. 1999). Imagine that a consumer considers purchasing a product and narrows down the choice to two alternatives described along several dimensions (see web appendix A for an illustration, the "compare to similar items" function on Amazon.com). In such a situation, this consumer may form a preference for one alternative over the other using two distinct comparative judgment strategies (Bettman, Johnson, and Payne 1991). On the one hand, this consumer may adopt a *dimension-by-dimension comparison strategy*, which involves comparing the alternatives along each individual dimension, and in a common variant of this approach, choosing the alternative with the greater number of superior dimensions (Shafir, Simonson, and Tversky 1993; Simonson 1989). On the other hand, this consumer may use an *absolute judgment strategy*, which involves evaluating each alternative separately and choosing the alternative with a higher overall evaluation (Parducci 1965). It is worth noting that, for a given consideration set, using the two distinct comparative judgment strategies may lead to different choices (Park and Kim 2005). Thus, which comparative judgment strategy consumers use is of great importance in determining their preferences and choices.

In the present research, we bridge the literature on anthropomorphism and research on social impression formation to propose that product anthropomorphism will influence the type of comparative judgment strategies that consumers adopt and affect their downstream preferences. The literature on anthropomorphism has shown that consumers tend to evaluate anthropomorphized products using beliefs and rules similar to the ones they use in judging people (Hur, Koo, and Hofmann 2015; Kim and McGill 2011; Puzakova, Kwak, and Rocereto 2013; Wan, Chen, and Jin 2017). Research on social impression formation has suggested that people tend to view each person as an integrated entity rather than as a collection of separate attributes to form good-enough and meaningful impressions (Asch 1946; Fiske 1992; Fiske and Neuberg 1990; Freeman and Ambady 2011; Hamilton, Katz, and Leirer 1980; Hamilton and Sherman 1996). Therefore, in light of the findings from these two lines of research, we expect that when imbuing two product alternatives in a comparison set with human-like characteristics, consumers tend to treat each product alternative as an integrated entity rather than a loose combination of instrumental attributes, and are less likely to compare them along separate dimensions. Thus, we propose that when facing a comparison set in which both options are anthropomorphized (vs. both being nonanthropomorphized), consumers will increase their likelihood of using an absolute judgment strategy in preference formation. Consequently, product anthropomorphism is expected to increase preference for the product option with a dominant overall evaluation (vs. the option with a dominant number of superior dimensions). In the following sections, we review the key literature and develop our hypotheses, present six empirical studies, and discuss our findings, contributions, and managerial implications.

THEORETICAL FRAMEWORK

Product Anthropomorphism

Anthropomorphism, or seeing the human in nonhuman objects, has long been a topic of great interest in a wide range of fields (Epley, Waytz, and Cacioppo 2007; Epley et al. 2008; Guthrie 1993; Kwan, Gosling, and John 2008; Waytz et al. 2010). In consumer research, product anthropomorphism refers to the phenomenon that people perceive inanimate products as having human-like physical and mental characteristics (Aggarwal and McGill 2007; Landwehr, McGill, and Herrmann 2011). Marketers frequently capitalize on product anthropomorphism as a marketing strategy, with the hope that anthropomorphism can lead to favorable changes in attitudes toward the target products (Puzakova et al. 2013). Scholarly work has discovered that anthropomorphism may influence consumer attitudes and choices in a variety of ways. First, consumers attribute to an anthropomorphized product (vs. a nonanthropomorphized product) both physical human-like features and mindfulness, which can be easily understood from the definition of product anthropomorphism (Aggarwal and McGill 2007; Epley and Waytz 2009; Hur et al. 2015). For example, anthropomorphism leads consumers to attend to the resemblance of products' features to humans' physical appearance (Aggarwal and McGill 2007); similarly, anthropomorphizing a computer-generated agent evokes perceptions of intelligence of this agent (Nass, Isbister, and Lee 2000).

Recent research in consumer behavior further suggests that people apply social beliefs in their interactions with anthropomorphized products (Aggarwal and McGill 2012; Chandler and Schwarz 2010; Chen, Wan, and Levy 2017; Kim and McGill 2011). For example, Chandler and Schwarz (2010) found that consumers induced to think about their car in anthropomorphic terms are less willing to replace the car, regardless of its quality, and are more likely to emphasize the traits deemed important in the interpersonal realm. Chen et al. (2017) showed that consumers who experience threat in belongingness are motivated to establish a social relationship with a brand that exhibits human-like features.

It is worth noting, however, that the majority of prior research has focused on consumers' responses to one specific anthropomorphized product, in comparison with its own nonanthropomorphized version or with another nonanthropomorphized product. Little previous research has examined how anthropomorphism influences the preferences for one anthropomorphized product over another anthropomorphized product. In the present research, we focus on the situations in which consumers compare two products that are both anthropomorphized, and investigate how anthropomorphism influences the way in which consumers make comparative judgments and eventually develop their preferences. In the next section, we elaborate the rationale concerning how people form social impressions of and compare other persons to understand how consumers compare two products that are both anthropomorphized.

Social Impression Formation

Existing literature on social impression formation in general shares the view that when encountering another person, people usually form an integrated impression of the entire person rather than seeing this person as consisting of separate traits (Asch 1946; Hamilton et al. 1980; Hamilton and Sherman 1996). This is because when judging another person, people need to make sense of the available information and to draw a meaningful and "good-enough" conclusion (Fiske 1992, 2013; Hamilton et al. 1980; Hamilton and Sherman 1996). However, each attribute, when isolated from the whole person, represents only fragmented information, which is of little help in making a meaningful judgment. Instead, forming overall impressions (vs. viewing persons as separate attributes) considers the cohesiveness and integration of attributes (Asch 1946; Hamilton et al. 1980). Thus, under normal circumstances, people need to judge another person in an integrated way, which typically involves combining individual information into a unitary entity (Himmelfarb 1972), instead of considering each attribute separately.

Fiske and Neuberg (1990) reviewed evidence that holistic impression formation processes take precedence over attribute-oriented processes in social perception. For example, in a study by Fiske et al. (1987), participants were presented with descriptions of several people and were asked to form impressions of them. The descriptions contained holistic labels as well as identifications of specific attributes. Participants were asked to verbalize their thinking process while forming impressions of the stimuli (i.e., the think-aloud approach). The researchers found that participants spontaneously made holistic judgments about the stimuli whenever a meaningful holistic label was given and interpreted the specific attributes in line with the initial holistic responses. More recent research by Meeren, van Heijnsbergen, and de Gelder (2005) provided electrophysiological evidence that person construal routinely involves complex integration at the early stage of processing (e.g., on average 115 ms) that synthesizes both facial features and body language to extract meaningful judgments. Freeman and Ambady (2011) reviewed the related theories and summarized the sophisticated integration process extensively used in person construal, which requires simultaneous synthesis of an enormous amount of information at various levels. Overall, previous research has established that individuals form impressions of another person as an integrated entity rather than considering each attribute separately. In this regard, each attribute of a person is embedded to the person as a whole and contributes to the overall impression in relation to other attributes.

The integrated approach to forming impressions of other people has also been shown to be effective in various domains involving comparative judgments of persons. For example, human resources researchers have documented the extensively used personnel selection method characterized by integrated processing. In making hiring decisions, firms aggregate multiple characteristics of each applicant regarding, for example, their work experience, professional skills, and social skills, to calculate one score for each applicant indicating his/her degree of efficiency, eventually comparatively ranking different candidates based on their integrated scores (Warning 2014). In the education domain, Childers and Rye (1987) described the typical strategy for assessing doctoral program applicants. A total score is calculated for each applicant based on important attributes such as academic skills, communication skills, and credentials, and applicants are ranked according to the total score. The rationale behind these selection processes is that an integrated approach is more meaningful and thus more predictive than comparing candidates along each attribute mechanically.

Thus, if a human being is typically perceived as an integrated entity in comparative judgment (Asch 1946; Childers and Rye 1987; Warning 2014), and if consumers apply social beliefs when interacting with an anthropomorphized product (Gilmore 1919; McGill 1998), then we expect that consumers tend to consider an anthropomorphized product as an integrated entity, and are

less likely to break down and compare the pieces of attributes separately. Such an analogy implies that product anthropomorphism may exert an effect on the selection of comparative judgment strategies and on preference formation. We discuss the research on comparative judgment and develop our hypotheses in the next section.

Anthropomorphism and Comparative Strategy

Consumers often encounter situations in which they need to generate preferences from a consideration set of alternatives (Hsee et al. 1999; Park and Kim 2005; Su and Gao 2014). Previous research on choice processes has established that preferences are often highly constructive, depending on the way in which the preferences are computed (Bettman, Luce, and Payne 1998). On the one hand, individuals may use an *absolute judgment* process, through which they evaluate each alternative separately by integrating the attribute values and then determine the choice with the highest overall evaluation (Parducci 1965). Alternatively, individuals may perform a *dimension-by-dimension comparison* of the alternatives along common dimensions. Using this approach, consumers will arrive at a decision based on these dimensional comparisons and, for example, choose the alternative with the largest number of superior dimensions (Park and Kim 2005; Shafir et al. 1993; Simonson 1989; Tversky 1969). However, preferences computed with these two different strategies are often inconsistent, and thus research has often put these two strategies together to compare (Kardes and Wyer 2013; Park and Kim 2005; Russo and Dosher 1983).

A variety of factors have been found to influence which comparative strategy people use when choosing among product options (Bettman et al. 1998; Biehal and Chakravarti 1982; Luce, Bettman, and Payne 1997; Wyer and Xu 2010). The information processing literature endorses bounded rationality (Simon 1955), such that consumers typically have limitations on their motivation and capacity (e.g., working memory and computational capabilities) to process information. When consumers are confronted with a decision, they may employ the process that is easiest to apply and that generates a solution quickly (Chaiken, Liberman, and Eagly 1989; Kardes and Wyer 2013). Since it is typically easier to perform a dimension-by-dimension comparison of the alternatives than it is to perform the cognitive work of integrating each alternative's values into an overall evaluation (Bettman et al. 1998; Russo and Dosher 1983), a dimension-by-dimension comparison is typically used as a heuristic cue. However, when an accuracy maximization motivation is activated, people are likely to use the more effortful absolute judgment strategy (Bettman et al. 1998; Creyer, Bettman, and Payne 1990), given their belief that greater effort does lead to better performance (Yates and Kulick 1977). People may also use the absolute judgment strategy to cope with the negative emotion elicited by the comparative judgment task (Luce et al. 1997).

In the present research, we take a novel perspective and propose that product anthropomorphism can systematically influence consumers' usage of comparative judgment strategies. As elaborated earlier, prior research has shown that people typically judge human beings as integrated entities rather than a collection of separate attributes (Asch 1946; Fiske and Neuberg 1990; Freeman and Ambady 2011; Hamilton et al. 1980; Hamilton and Sherman 1996) and that consumers tend to interact with humanized products as they do with human beings (Aggarwal and McGill 2012; Chandler and Schwarz 2010; Chen et al. 2017). We thus expect that anthropomorphizing products will prompt consumers to form impressions of each product option as an integrated entity in comparative judgment. In line with this logic, we predict that product anthropomorphism will increase consumers' likelihood of using an absolute judgment strategy that allows them to employ an integrated approach when comparing product alternatives. Consequently, product anthropomorphism will enhance consumers' preferences for the product alternative with a higher overall evaluation score.

It is worth noting that in addition to absolute versus dimensional differentiation of comparative strategies, prior research has documented some other approaches to classify comparative judgment strategies (Bettman et al. 1998; Payne, Bettman, and Johnson 1993). For example, comparative judgment strategies can be classified as either compensatory (i.e., assuming trade-offs among attributes) or noncompensatory (Johnson and Meyer 1984). The absolute judgment strategy in our research can also be termed as a compensatory alternative-based strategy. And there are noncompensatory alternative-based strategies such as a conjunctive decision strategy, which states that an alternative failing to pass a low threshold value on any dimension will be rejected (Coombs 1964; Dawes 1964; Einhorn 1970). As discussed earlier, anthropomorphism leads consumers to consider each product alternative as an integrated entity, and for this reason they adopt an absolute judgment strategy, which allows them to do so; in contrast, noncompensatory alternative-based strategies do not treat each alternative as an integrated entity, and thus anthropomorphism should not increase the adoption of a noncompensatory alternative-based strategy. For dimension-based strategies, previous research has also documented both a noncompensatory way (e.g., the majority-of-confirming-dimensions strategy, which involves choosing the alternative with a greater number of superior dimensions) and a compensatory way (e.g., the additive difference strategy, which considers the relative sizes of the superiority when comparing dimensions) (Russo and Dosher 1983; Tversky 1969). Previous literature shows that when dimension-based processing is applied, the noncompensatory way "reduces the computational effort of the full dimensional

strategy [the compensatory dimension-based strategy]" and is more commonly used (Russo and Dosher 1983, 693). Although our research does not focus on which dimension-based strategy should be adopted for comparing nonanthropomorphized products, we do share the same opinion with previous researchers that the noncompensatory one is more likely to be used in normal situations when people decide to adopt a dimension-based rule. To summarize, we argue that product anthropomorphism increases adoption of an absolute judgment strategy (also known as a compensatory alternative-based strategy), which allows for treating each product as an integrated entity. Formally, we hypothesize the following:

H1: Consumers are more likely to use an absolute judgment strategy in comparative judgment when two product alternatives are anthropomorphized than when they are not anthropomorphized.

H2: Consumers will have an increased preference for the product alternative with a more favorable overall evaluation (i.e., an absolute-dominant alternative) over the alternative with a greater number of superior dimensions (i.e., a dimension-dominant alternative) when the product alternatives are anthropomorphized than when they are not anthropomorphized.

H3: The effect of product anthropomorphism on product preference in comparative judgment is mediated by consumers' perception of each product alternative as an integrated entity.

As mentioned earlier, under normal circumstances, when people form impressions of human beings, they usually look for a "good-enough" conclusion (Fiske 1992, 2013; Hamilton et al. 1980; Hamilton and Sherman 1996). In other words, people are neither necessarily motivated to maximize accuracy nor to get the job done extremely easily in impression formation. Instead, in the ease–accuracy trade-off, people reach a meaningful and good-enough judgment, which involves considerations of both accuracy and efforts. However, in some cases, people may shift away from their normal good-enough criteria and seek either maximized accuracy (e.g., to make an accurate decision without time constraint) or ease (e.g., to make a less effortful decision with time constraint). Accordingly, their comparative strategy may also change in situations involving comparative judgment. Based on previous research, the accuracy (ease) motivation can increase the usage of an absolute (dimension) strategy (Creyer et al. 1990). Thus, consumers may be more likely to use an absolute (dimension) strategy not only for anthropomorphized products but also for nonanthropomorphized products when they have the accuracy (ease) motivation. Formally, we hypothesize the following:

H4: The effect of product anthropomorphism on preference in comparative judgment is moderated by the motivation to seek maximized accuracy or ease. Specifically, the proposed effect should hold when consumers are in a normal situation (i.e., seeking a good-enough conclusion). When consumers have the accuracy (ease) motivation, their preferences for an absolute-dominant alternative (a dimension-dominant alternative) will increase both when comparing anthropomorphized products and when comparing nonanthropomorphized products.

OVERVIEW OF STUDIES

We conducted six experiments to test these hypotheses. The first two experiments traced in detail the comparative judgment processes of two anthropomorphized (vs. nonanthropomorphized) products using MouseLab software (experiment 1A) and eye-tracking technique (experiment 1B). These process-tracing techniques provide direct evidence of the effect of product anthropomorphism on the use of comparative strategies in information processing (hypothesis 1). Experiments 2 through 4 tested the downstream consequence of product anthropomorphism on consumers' preferences in comparative judgment (hypothesis 2) in hypothetical or real choice settings. Experiments 3A and 3B also tested the proposed underlying mechanism (hypothesis 3) using both a self-reported measure of integrated perception of each product alternative (experiment 3A) and a subtle proxy for integrated processing (experiment 3B). Experiments 4 further tested the moderating role of the motivation to seek maximized accuracy or ease (hypothesis 4).

EXPERIMENT 1A: TRACING THE COMPARATIVE JUDGMENT PROCESS USING MOUSELAB

Experiment 1A tested the hypothesis that product anthropomorphism increases the use of the absolute judgment strategy in comparative judgment (hypothesis 1) using MouseLab, a computer-based process-tracing technique that has been widely used to assess comparative judgment strategies (Dhar and Nowlis 2004; Johnson, Payne, and Bettman 1988; Su and Gao 2014). In this experiment, information about two product alternatives—either both anthropomorphized or both nonanthropomorphized—was displayed on a computer screen in six closed boxes presented as an alternative (2) × dimension (3) matrix. Participants could reveal the information in each box only by moving a mouse-controlled cursor to the relevant box. Thus we could instantly monitor participants' comparative judgment strategies by tracing the movements of the mouse.

Method

Participants and Design. Sixty-seven undergraduate students (63.04% female, M_{age} = 20.04, SD = 1.47)

participated in the study in exchange for a monetary reward. They were randomly assigned to conditions of a one-factor, two-level (anthropomorphism of products: anthropomorphism vs. nonanthropomorphism) between-subjects design.

Procedure. Each participant was presented with two restaurant alternatives side by side, described along three dimensions: "cleanliness," "food quality," and "inexpensiveness." Information about the two restaurant alternatives was presented on the computer screen in the form of an alternative (2) × dimension (3) matrix (see web appendix B for a description of the stimuli). The positions of the two alternatives were arranged horizontally and counterbalanced, whereas the information about each attribute within an alternative was placed vertically and counterbalanced. The information in each of the six cells of the matrix was hidden behind a masked box, which showed the dimension label only, and the participants had to open one box at a time to see the information for each dimension of an alternative. MouseLab recorded which boxes each participant opened, and in what sequence. The anthropomorphism of the restaurant alternatives was manipulated following the approach of Puzakova et al. (2013). Specifically, in the anthropomorphism condition, both restaurant alternatives were described in first-person language. Additionally, participants were encouraged to concentrate on thinking of each of the two restaurant options as a person who had come to life and was introducing him/herself to the participants. In the nonanthropomorphism condition, however, both options were described in third-person language, with no humanizing instruction presented.

Participants read the instructions on how to access the information in each box and then moved to the task involving processing the information about the two restaurant options. Participants were told that the research was intended to understand how they processed product information, and were asked to do so by moving the mouse to assess the restaurant information. To check the effectiveness of the anthropomorphism manipulation, participants then rated three statements: "I think the product sounds like a person/seems as if it has free will/seems as if it has intentions" (1 = totally disagree, 9 = totally agree; Kim and McGill 2011). Participants' responses to the three items were averaged to form an anthropomorphism index ($\alpha = .92$). Finally, we measured participants' involvement, effort, familiarity with the product category, and mood state (unpleasant/pleasant, calm/aroused, tired/energetic, and negative/positive).

Scoring. We calculated two types of mouse movements to trace the comparative judgment process, following the method used in prior research (Payne 1976; Payne, Bettman, and Johnson 1988; Sen 1998; Sen and Johnson 1997). Specifically, one type of movement concerned transitions within the same alternative but across different dimensions (i.e., an alternative-based transition), while the other type involved transitions along the same dimension but between different alternatives (i.e., a dimension-based transition). For example, if a participant first checked the food quality of one restaurant and then the cleanliness of the same restaurant, this would be coded as an alternative-based transition; if a participant first checked the food quality of one restaurant and then the food quality of the other restaurant, this movement would be coded as a dimension-based transition. Following previous research (Payne 1976; Payne et al. 1988), all other movements (e.g., from the food quality of one restaurant to the cleanliness of the other restaurant) were not included in the calculation.

We discerned the relative degree to which participants made alternative-based or dimension-based transitions by calculating the number of alternative-based transitions minus the number of dimension-based transitions divided by the total number of alternative-based and dimension-based transitions combined. Such a measure, known as a PATTERN value (Payne et al. 1988), served as an indicator of the comparative judgment strategy that participants relatively relied on. PATTERN value ranges from –1.0 to 1.0, with a more positive value representing a greater proportion of using an absolute judgment strategy and a more negative value indicating a greater proportion of using a dimension-by-dimension strategy.

Results

Manipulation Check. Participants perceived the restaurant alternatives as more humanized in the anthropomorphism condition than in the nonanthropomorphism condition ($M = 4.65$, SD = 1.95 vs. $M = 3.72$, SD = 1.40; $F(1, 65) = 4.76$, $p = .033$, $\eta^2_p = .07$). Participants in the two conditions reported no statistically significant difference in terms of involvement ($F(1, 65) = .73$, $p = .396$), effort ($F(1, 65) = .58$, $p = .450$), familiarity with restaurants ($F(1, 65) = .10$, $p = .758$), or mood state (Fs $< .77$, ps $> .385$).

PATTERN Values. We calculated PATTERN values as mentioned above, with a more positive (negative) value indicating a greater proportion of using an absolute judgment strategy (a dimension-by-dimension strategy). Consistent with our prediction, results from a one-way ANOVA revealed that product anthropomorphism significantly affected the PATTERN values for comparing the two restaurant alternatives ($M_{\text{anthropomorphism}} = .14$, SD = .24 vs. $M_{\text{nonanthropomorphism}} = -.09$, SD = .39, $F(1, 65) = 8.15$, $p = .006$, $\eta^2_p = .11$; see table 1), indicating that anthropomorphism (vs. nonanthropomorphism) increased the relative use of an absolute judgment strategy. These results support hypothesis 1.

TABLE 1

COMPARATIVE JUDGMENT STRATEGY AND PRODUCT PREFERENCE AS A FUNCTION OF PRODUCT ANTHROPOMORPHISM: EXPERIMENTS 1A, 1B, 2, 3A, AND 3B

Experiments	Anthropomorphism condition	Nonanthropomorphism condition	Stimuli	Dependent variable
Experiment 1A	14 (.24)	−.09 (.39)	Restaurant	Process (MouseLab)
Experiment 1B	19 (.29)	.04 (.41)	Camera	Process (eye-tracking)
Experiment 2	6.15 (2.38)	4.95 (2.95)	Laptop	Self-reported preference
Experiment 3A	65.71%	37.50%	Snack	Real choice
Experiment 3B	5.62 (1.34)	4.79 (1.63)	Stereo speaker	Self-reported preference

NOTE.–Table displays means/percentages for each condition. Standard deviations are reported in parentheses.

EXPERIMENT 1B: TRACING COMPARATIVE JUDGMENT PROCESS USING EYE TRACKING

Experiment 1B used the eye-tracking approach to seek further process evidence that anthropomorphism increases the chance of using an absolute judgment strategy in comparative judgment. Experiment 1B differed from experiment 1A in four respects. First, experiment 1B provided evidence of participants' physiological responses through recording eye movements, which are not easily controllable by participants. Second, while the MouseLab approach in experiment 1A required participants to search for information hidden within the alternative × dimension matrix, the eye-tracking technique in experiment 1B allowed participants to effortlessly access information that was continuously available in a natural information-processing setting. Third, to simulate a realistic purchase situation and to increase the external validity of our findings, the product descriptions in experiment 1B matched actual descriptions on Amazon.com. Finally, the eye-tracking technology allowed us to record and test more indicators of participants' comparative judgment process than the MouseLab technique, which helped to provide a better understanding of participants' comparative judgment process.

Method

Participants and Design. Ninety-seven undergraduate students (65.93% female, $M_{age} = 20.22$, SD = 1.39) were recruited to participate in the experiment in exchange for monetary compensation, and were randomly assigned to either a product anthropomorphism condition or a nonanthropomorphism condition. The data from six participants who were physically incompatible with participation in the eye-tracking study (i.e., self-reported weak eyesight) were removed from the study sample, leaving a total of 91 participants in the data analyses.

Apparatus and Stimuli. A cloud-based eye tracker in the form of a peripheral device attached to a laptop computer in the research laboratory recorded participants' eye movements. The eye-tracking software calculated eye gaze coordinates with an average accuracy of around 0.5 to 1° of visual angle. Participants sat approximately 60 centimeters away from the computer screen.

Participants were asked to compare a pair of digital cameras, the Canon EOS 70D and the Olympus E-M5 Mark, described along three dimensions of "customer reviews," "image quality," and "optical zoom." The names and information for both digital cameras were directly adopted from Amazon.com. The product information was presented on two full-color pages on the computer screen (see web appendix C for a description of the stimuli): the first page showed pictures and introduced the two digital cameras; the second page presented detailed descriptions of the cameras with an alternative (2) × dimension (3) matrix. The page layout was designed to resemble the "compare to similar items" interface on Amazon.com.

In the anthropomorphism condition, both digital camera alternatives were described in first-person language to accompany a product image with human-like elements (e.g., eyes and limbs). As in experiment 1A, participants were instructed to concentrate on thinking of each product as a person. In contrast, in the nonanthropomorphism condition, the alternatives were presented with third-person language and an image without human-like elements. Also, participants in this condition did not receive the anthropomorphism instruction. To ensure that the manipulation of anthropomorphism was successful and to measure participants' impression of the product pictures, we conducted an independent pretest using participants from the same subject pool as in the main study. One hundred fifty-two participants were randomly assigned to conditions of a 2 (product anthropomorphism: anthropomorphism vs. nonanthropomorphism) × 2 (product version: Canon EOS 70D vs. Olympus E-M5 Mark) between-participants design. Participants reported the perceived anthropomorphism of the alternatives along the same three scales that were used in experiment 1A ($\alpha = .94$), and the attractiveness of the stimulus in each condition along a scale from 1 (not at all) to 9 (very much). The manipulation of product anthropomorphism was successful ($M_{anthropomorphism} = 5.86$, SD = 1.68 vs. $M_{nonanthropomorphism} = 2.48$, SD = 1.50; $F(1, 148) = 167.86$,

$p < .001$, $\eta^2_p = .53$). Additionally, we found that the pictures of the two digital cameras were equally attractive in both the anthropomorphism condition ($M_{\text{Canon EOS 70D}} = 5.00$, SD = 2.08 vs. $M_{\text{Olympus E-M5 Mark}} = 4.97$, SD = 2.08; $F(1, 148) = .00$, $p = .955$) and the nonanthropomorphism condition ($M_{\text{Canon EOS 70D}} = 5.86$, SD = 1.77 vs. $M_{\text{Olympus E-M5 Mark}} = 6.39$, SD = 1.90; $F(1, 148) = 1.35$, $p = .247$). Product anthropomorphism, however, had a main effect on perceived attractiveness, such that anthropomorphized digital cameras ($M = 4.99$, SD = 2.09) were less attractive than nonanthropomorphized ones ($M = 6.13$, SD = 1.84; $F(1, 148) = 12.74$, $p < .001$, $\eta^2_p = .08$). We will further discuss and address the attractiveness issue in later studies.

Procedure. Upon arrival, participants were told that we were interested in understanding how consumers process information about product alternatives in the same category. They were required to sit still and keep their eyes on the screen during the experiment. We calibrated the eye-tracking device by asking participants to focus on nine red calibration dots that were presented sequentially on different areas of the computer screen (Brisson et al. 2013; Wedel and Pieters 2006). After the calibration, the instructions for the main task appeared on the screen. Participants were told to read the information about the two digital cameras as if they were actually making a purchase. Participants' eye movements while reading the product descriptions were recorded by the eye tracker.

Scoring. The eye tracker recorded participants' eye movements, the amount of time they spent, and their eye fixations. The recorded information was categorized into areas of interest that were defined a priori. Six areas of interest (AOI) were specified for the product information page, with each AOI defined as one of the six cells of the alternative (2) × dimension (3) matrix. The amount of time the eyes paused on each area, the number of eye fixations on each area, and the number of eye movements between areas were computed. As in experiment 1A, to trace participants' comparative judgment strategies, we counted alternative-based transitions and dimension-based transitions and calculated the PATTERN values (Payne et al. 1988), with a more positive (negative) value indicating a greater proportion of using an absolute judgment strategy (a dimension-by-dimension strategy).

Results

PATTERN Values. Consistent with our prediction, analyses of the PATTERN values showed that when both digital camera alternatives were anthropomorphized, participants used a greater proportion of alternative-based transitions in comparing the two cameras ($M = .19$, SD = .29) than when both cameras were nonanthropomorphized ($M = .04$, SD = .41; $F(1, 89) = 4.02$, $p = .048$, $\eta^2_p = .04$; see table 1). These results supported our hypothesis that product anthropomorphism increases the relative use of an absolute judgment strategy (vs. a dimension-by-dimension strategy).

Other Measures. Analyses of the time that participants spent on all six AOIs showed that participants spent similar amounts of time (in seconds) to process information about the digital cameras in the anthropomorphism condition ($M = 14.04$, SD = 5.41) and the nonanthropomorphism condition ($M = 13.14$, SD = 5.33; $F(1, 89) = .64$, $p = .428$). Similarly, analyses of eye fixations in all six AOIs showed that participants had a similar number of eye fixations in the anthropomorphism condition ($M = 138.76$, SD = 47.44) and the nonanthropomorphism condition ($M = 128.31$, SD = 48.42; $F(1, 89) = 1.08$, $p = .301$). Thus, besides the similar levels of self-reported involvement and effort between the anthropomorphism and nonanthropomorphism conditions in this and other studies, the similar amounts of time and eye fixation for comparison provide further evidence that the effect of product anthropomorphism on the use of comparative strategies could not be explained by differences in participants' amount of attention or deliberation.

Moreover, within the attribute (2) × dimension (3) matrix of the information page for the two digital cameras, participants were allowed three types of horizontal eye movements and six types of vertical eye movements. Analyses of these movements showed that the average number of each type of movement was higher than 1.0 for both the anthropomorphism (ts > 4.50, ps < .001, η^2_ps > .18) and nonanthropomorphism conditions (ts > 4.30, ps < .001, η^2_ps > .17). These results indicated that, no matter which strategy participants primarily relied on, they were not totally unaware of the other possibility and used the other type of transition.

Discussion

Experiment 1A tested our hypotheses with MouseLab software, a computer-based technique used to trace mouse movements that reflect individuals' information processing in comparative judgments. Experiment 1B provided direct physiological evidence by capturing individuals' eye movements in comparing the product alternatives. Collectively, experiments 1A and 1B provided converging process evidence showing that product anthropomorphism increases the relative use of an absolute judgment strategy. In addition, the process evidence from experiments 1A and 1B helps validate the claim that product anthropomorphism exerts an effect at the product information-processing stage besides providing a rule at the decision-making stage.

EXPERIMENT 2: THE EFFECT OF PRODUCT ANTHROPOMORPHISM ON PREFERENCES

Experiment 2 examined the effect of product anthropomorphism on preferences between two alternatives based on comparative judgment strategies (hypothesis 2). Specifically, participants were presented with a pair of product alternatives in the same category for evaluation. Both options were described along three dimensions. One option was designed to be preferred if participants used an absolute judgment strategy (i.e., the absolute-dominant alternative with an overall more favorable evaluation but a smaller number of superior dimensions), whereas the other option was designed to be preferred if a dimension-by-dimension strategy was used (i.e., the dimension-dominant alternative with a greater number of superior dimensions but an overall less favorable evaluation). We predicted that when confronting a pair of anthropomorphized products, as compared to a pair of nonanthropomorphized products, participants would be more likely to use the absolute judgment strategy, leading to greater preference for the absolute-dominant option over the dimension-dominant option.

Method

Participants and Design. A total of 101 participants (55.45% female, $M_{age} = 32.02$, SD = 6.95) were recruited on Amazon Mechanical Turk (MTurk). They were randomly assigned to two conditions of a one-factor, two-level (anthropomorphism of products: anthropomorphism vs. nonanthropomorphism) between-subjects design.

Procedure. All participants were presented with descriptions of two laptop computers for evaluation. Based on a within-participants independent pretest with 32 additional participants from the same subject pool as the main study, three equally important dimensions were selected to develop the descriptions: "inexpensiveness," "hard disk capacity," and "screen resolution" ($M = 6.97$, SD = 2.22 vs. $M = 7.16$, SD = 1.87 vs. $M = 7.00$, SD = 1.50; 1 = not important at all, 9 = very important; Fs < .14, ps > .710). The favorableness of the two laptops along each dimension was described using a number of stars rating system, with more stars indicating higher favorableness (see web appendix D for a description of the stimuli). For the absolute-dominant laptop Belio 2.0, the three dimensions received two, three, and five stars; for the dimension-dominant laptop Litek 2.0, the three dimensions correspondingly received three, four, and two stars, respectively. Thus, the sum of values along all three dimensions was greater for the absolute-dominant laptop (i.e., 10 stars) than for the dimension-dominant laptop (i.e., nine stars). In contrast, the dimension-dominant laptop had a higher value along more dimensions (i.e., two dimensions) than the absolute-dominant laptop (i.e., one dimension). We manipulated the anthropomorphism of the laptop alternatives using the same approach as in experiment 1A. In the anthropomorphism condition, participants were encouraged to humanize both laptop alternatives, which were described in first-person language. In the nonanthropomorphism condition, however, both alternatives were presented in third-person language without humanizing instruction. In both conditions, the two alternatives were presented side-by-side. The order of presentation of the description information for each alternative and the dimension × value combinations were fully counterbalanced.

Participants' preferences between the two laptop alternatives were captured in responses to the two items "Which product do you like more?" and "Which product would you like to own more?" along nine-point scales. We reverse-coded half of the data due to the counterbalance of the order of product alternatives and eventually obtained responses with 1 indicating preference for the dimension-dominant laptop Litek 2.0 and 9 indicating preference for the absolute-dominant laptop Belio 2.0. Participants' responses to these items were averaged to form a preference index ($r = .97$, $p < .001$). As in experiment 1A, participants then completed a three-item manipulation check of product anthropomorphism ($\alpha = .95$) and the measures of involvement, effort, familiarity with the product category, and mood state.

Results

Manipulation Check. As expected, participants perceived the laptop alternatives as more human-like in the anthropomorphism condition ($M = 2.79$, SD = 1.93) than in the nonanthropomorphism condition ($M = 1.31$, SD = .83; $F(1, 99) = 24.95$, $p < .001$, $\eta^2_p = .20$). No significant effect of anthropomorphism was found on involvement ($F(1, 99) = .84$, $p = .363$), effort ($F(1, 99) = 1.27$, $p = .262$), familiarity with laptops ($F(1, 99) = .11$, $p = .738$), or mood state (Fs < 1.51, ps > .223).

Laptop Preferences. Consistent with our prediction, the results of a one-way ANOVA showed that participants in the anthropomorphism condition preferred the absolute-dominant laptop over the dimension-dominant laptop to a greater extent ($M = 6.15$, SD = 2.38) than those in the nonanthropomorphism condition ($M = 4.95$, SD = 2.95; $F(1, 99) = 5.04$, $p = .027$, $\eta^2_p = .05$; see table 1). These results supported hypothesis 2 that consumers' preferences for an absolute-dominant alternative over a dimension-dominant alternative are greater when the alternatives are both anthropomorphized than when they are not.

Discussion

The results of experiment 2 support our prediction that anthropomorphism of product alternatives in a consideration set increased preference for the alternative favored by an absolute judgment strategy over the alternative favored by a dimension-by-dimension strategy. Although experiments 1A, 1B, and 2 showed the effect of product anthropomorphism on comparative strategies and preferences in the manner we predicted, none of them specified the underlying mechanism. Hence, in experiments 3A and 3B, we delved further into the process. More specifically, experiment 3A and 3B tested the hypothesis that the proposed effect of product anthropomorphism is mediated by the extent to which consumers perceive each product alternative as an integrated entity.

EXPERIMENT 3A: MEASURING PSYCHOLOGICAL PROCESS WITH SELF-REPORTED PERCEPTION

Experiment 3A had three objectives. First, it constituted an initial attempt to investigate the underlying mechanism of the proposed effect (hypothesis 3). In experiment 3A, we assessed participants' self-reported integrated perception of each product alternative. We expected that presenting product alternatives in a humanized manner would lead people to consider each option as an integrated entity rather than a collection of separate attributes, resulting in a preference for the alternative with the more favorable overall evaluation over the one with a greater number of superior dimensions. Second, experiment 3A was conducted to generalize our findings from reported preferences to real choices. Third, in experiment 3A, instead of explicitly asking participants to concentrate on thinking of each product alternative as a person as in previous experiments, we manipulated anthropomorphism in a more practical way, using the anthropomorphized package design of a real product together with verbal descriptions.

Method

Participants and Design. A total of 75 undergraduate students (64.00% female, $M_{age} = 20.36$, SD = 1.29) participated in the experiment in exchange for course credit. They were randomly assigned to two (anthropomorphism of products: anthropomorphism vs. nonanthropomorphism) between-subjects conditions.

Procedure. Participants were told that we were interested in their choices between a pair of caramel corn snacks, and were shown pictures of and information about the two snacks. They were asked to read the information as they would in a supermarket, and then choose the one that they would prefer to purchase. Participants were told that at the end of the experiment they could get the exact snack that they chose. Both caramel corn snack alternatives were from the same Japanese brand, Tohato, with the same size (i.e., 80 grams) for approximately the same price (about US$1 per bag), differing only in flavor (i.e., "cheese cake" flavor and "creamy milk" flavor). The packaging of caramel corn snacks by Tohato is designed with anthropomorphic features such that the package looks like a human face with eyes, nose, and mouth, which makes the products suitable for this experiment. In the anthropomorphism condition, both caramel corn snack alternatives were presented in first-person language with the pictures of the original humanized packages. In the nonanthropomorphism condition, both alternatives were described in third-person language. In addition, the pictures of the original packages were revised using Photoshop software such that all human-like elements were removed (see web appendix E for a description of the stimuli).

Participants were presented with descriptions of the two caramel corn snack options in an alternative (2) × dimension (3) matrix, accompanied by pictures of both snacks. Based on a pretest with an independent sample of 32 students from the same subject pool as the main study, three equally important dimensions were selected for the descriptions: "degree of low fat," "degree of low artificial additives," and "proportion of natural ingredients" ($M = 6.22$, SD = 2.76 vs. $M = 6.13$, SD = 2.17 vs. $M = 5.75$, SD = 1.95; 1 = not important at all, 9 = very important; Fs < 1.19, ps > .284). The favorableness along each dimension was described using numbers, with greater numbers indicating greater favorableness. For the absolute-dominant corn snack named Viget, the three dimensions scored 4, 6, and 10; for the dimension-dominant corn snack named Altius, the three dimensions correspondingly scored 6, 8, and 4, respectively. Thus, the sum of values along all three dimensions was greater for the absolute-dominant corn snack (i.e., 20) than for the dimension-dominant corn snack (i.e., 18). In contrast, the dimension-dominant corn snack had greater values along more dimensions (i.e., two dimensions) than the absolute-dominant corn snack (i.e., one dimension). The order of product description information and the dimension × value combinations were fully counterbalanced.

Similar to experiment 1B, we measured participants' impressions of the two product pictures using an independent pretest. One hundred forty-four participants were randomly assigned to conditions of a 2 (product anthropomorphism: anthropomorphism vs. nonanthropomorphism) × 2 (snack version: Altius vs. Viget) between-subjects design. Participants reported the attractiveness of the stimulus along a scale from 1 (not at all) to 9 (very much). The pictures of the two snacks were equally attractive in both the anthropomorphism condition ($M_{Altius} = 6.42$, SD = 1.41 vs. $M_{Viget} = 6.58$, SD = 1.33; $F(1, 140) = .23$, $p = .636$) and the nonanthropomorphism condition ($M_{Altius} = 5.35$, SD = 1.59 vs. $M_{Viget} = 5.41$,

SD = 1.48; $F(1, 140) = .03$, $p = .867$). Moreover, product anthropomorphism had a main effect on perceived attractiveness. However, in contrast to experiment 1B in which anthropomorphized cameras were less attractive than nonanthropomorphized ones, in this experiment anthropomorphized snacks were more attractive than nonanthropomorphized ones ($M = 6.50$, SD = 1.36 vs. $M = 5.38$, SD = 1.53; $F(1, 140) = 23.31$, $p < .001$, $\eta^2_p = .14$). Given this inconsistency in the effects of anthropomorphism on perceived attractiveness of the products, the attractiveness of products cannot explain the effect of the manipulation of anthropomorphism. We will further discuss the issue of product attractiveness in the next experiment.

After reading the descriptions about the corn snack alternatives, participants indicated their choice between the two alternatives. Then participants' perception of each alternative as an integrated entity was captured by two items: "To what extent do you view each product as (1 = a bundle of attributes, 9 = an integrated entity)?" and "To evaluate different options of products, it is more important to pay attention to (1 = the performance of individual attributes, 9 = the overall performance of each product)." Responses to the two items were averaged to form an index of integrated perception, which served as the mediator measure ($r = .69$, $p < .001$). Finally, participants rated the manipulation-check items of the anthropomorphism manipulation as in previous experiments ($\alpha = .87$), and confounding-check items. Upon completion of the study, participants received the caramel corn snacks they actually chose.

Results

Manipulation Check. As predicted, participants in the anthropomorphism condition perceived the corn snacks as more human-like ($M = 4.41$, SD = 1.63) than their counterparts in the nonanthropomorphism condition ($M = 2.56$, SD = 1.35; $F(1, 73) = 29.01$, $p < .001$, $\eta^2_p = .28$). No significant effect of anthropomorphism was found on familiarity with snacks ($F(1, 73) = 1.10$, $p = .298$) or mood state (Fs < 1.85, ps > .178).

Choices Data. We performed chi-square analysis with the anthropomorphism manipulation as the independent variable and participants' choice of absolute-dominant or dimension-dominant corn snack as the dependent variable. Consistent with previous experiments, participants in the product anthropomorphism condition were more likely to choose the absolute-dominant snack over the dimension-dominant snack, as compared to their counterparts in the nonanthropomorphism condition (65.71% vs. 37.50%; $\chi^2(1) = 5.95$, $p = .015$, $\eta^2_p = .08$; see table 1).

Perception of Each Alternative as an Integrated Entity and Mediation Analysis. As expected, imbuing product alternatives with human-like elements increased participants' perception of each alternative as an integrated entity rather than a bundle of attributes ($M = 6.24$, SD = 1.76), as compared to presenting the product alternatives without the human-like elements ($M = 5.18$, SD = 2.02; $F(1, 73) = 5.89$, $p = .018$, $\eta^2_p = .07$).

The perception of each alternative as an integrated entity was assumed to mediate the influence of anthropomorphism on participants' choices. To test this hypothesis, we conducted mediation analysis using the PROCESS macro developed by Hayes (2013, model 4). Bootstrapping involving 5,000 resamples from the data revealed that the effect of product anthropomorphism (1 = anthropomorphism, 0 = nonanthropomorphism) on participants' choices (1 = absolute-dominate alternative, 0 = dimension-dominant alternative) was mediated by their perception of each alternative as an integrated entity (95% CI [.0274, .9404]). These results supported our hypothesis regarding the underlying mechanism (hypothesis 3).

Discussion

Experiment 3A provided additional empirical evidence in a real choice context in support of the prediction that product anthropomorphism increases consumers' preferences for the absolute-dominant product alternative over the dimension-dominant alternative. More importantly, experiment 3A provided initial evidence of the perception of each alternative as an integrated entity as the underlying mechanism through self-reported measures. In experiment 3B, we sought to further examine the underlying mechanism of the integrated perception using a subtler measure.

EXPERIMENT 3B: MEASURING PSYCHOLOGICAL PROCESS WITH GESTALT TASK

Whereas experiment 3A used participants' self-reported integrated perception of each alternative to assess the underlying mechanism, experiment 3B adopted a subtle proxy for integrated processing—namely, the Gestalt Completion Task (Ekstrom et al. 1976)—to further test the mediation. In this task, participants viewed a series of fragmented pictures of familiar objects and were asked to perceptually integrate the fragments and recognize the objects. Prior research has established that performance on the Gestalt Completion Task reflects the tendency to process information in an integrated way (Crawford 1981; McCrea, Wieber, and Myers 2012). For example, Crawford (1981, 377) used this task to measure the extent to which participants "simultaneously associate the parts rather than analyze the individual parts successively." More recently, McCrea et al. (2012) used performance on this task to predict participants' tendency to synthesize detailed descriptions of a target person to form an overall impression. Thus, performance of the Gestalt Completion

Task can serve as a subtle proxy for the proposed mediator (i.e., integrated processing).

Moreover, in experiment 3B we presented descriptions of the two alternatives along five dimensions rather than three dimensions as in our previous experiments, to test the robustness of the effect for a larger number of dimensions. Finally, experiment 3B also aimed at ruling out an alternative explanation concerning the maximum-attractiveness-difference rule. Specifically, one may argue that product anthropomorphism may lead participants to focus on the dimension that differs the most between the two product options, and eventually influence the preference. In experiment 3B we had two maximum-difference dimensions and made each option superior along one such dimension. Thus, the results, if they replicate previous experiments, would not be readily explained by the maximum-difference dimension account. Finally, unlike previous experiments, which simultaneously used multiple methods to manipulate anthropomorphism, in this and subsequent experiments, we used only one manipulation method in each experiment.

Method

Participants and Design. Eighty-three undergraduate students (59.04% female, $M_{age} = 20.48$, SD = 2.94) were recruited to participate in the experiment in exchange for course credit. They were randomly assigned to two (anthropomorphism of products: anthropomorphism vs. nonanthropomorphism) between-subjects conditions.

Procedure. All participants were presented with descriptions of two stereo speakers side-by-side in an alternative (2) × dimension (5) matrix, accompanied by pictures of both stereo speakers (see web appendix F for a description of the stimuli). Based on a within-participants design pretest with 31 independent participants from the same subject pool as the main study, five equally important dimensions were selected to develop the descriptions: "connectivity convenience," "volume range," "signal-to-noise ratio," "service life," and "bass sound quality" ($M = 7.13$, SD = 1.38 vs. $M = 6.94$, SD = 1.46 vs. $M = 7.03$, SD = 1.14 vs. $M = 7.19$, SD = 2.01 vs. $M = 7.26$, SD = 1.39; 1 = not important at all, 9 = very important; Fs < 1.02, ps > .320). Similar to experiment 3A, in the main study, favorableness along each dimension was described using numbers, with greater numbers indicating greater favorableness. For the absolute-dominant stereo speaker named Canetis, the sum of numbers along all five dimensions was greater, whereas for the dimension-dominant stereo speaker named Aequitas, more dimensions had greater numbers. To rule out the maximum difference explanation, we had two maximum-difference dimensions and made each alternative superior along one maximum-difference dimension. For example, as illustrated in web appendix F, the dimension-dominant stereo speaker was superior along the maximum-difference dimension of service life (5 vs. 1) and the absolute-dominant stereo speaker was superior along the maximum-difference dimension of bass sound quality (5 vs. 1). Thus, the difference in preference, once found, cannot be explained by the maximum-difference account. The order of product description information and the dimension × value combinations were fully counterbalanced.

We manipulated anthropomorphism of the stereo speakers by changing only the shape of each speaker's diaphragms in the pictures (see web appendix F). In the anthropomorphism condition, each speaker's two diaphragms resembled the eyes of a human being; in the nonanthropomorphism condition, we arranged the diaphragms as flat panels, which did not resemble human features. The appearance of the speakers was otherwise the same for both conditions. To measure participants' impression of the stereo speaker designs, we conducted an independent pretest using additional participants from the same subject pool as in the main study. One hundred twenty-four participants were randomly assigned to conditions of a 2 (product anthropomorphism: anthropomorphism vs. nonanthropomorphism) × 2 (product version: Canetis vs. Aequitas) between-participants design. Participants rated the extent to which the stimulus in each condition was perceived as attractive, cute, fun, exciting, and playful along scales from 1 (not at all) to 9 (very much). We found no significant effects on any of these measures (for attractive: Fs < .84, ps > .363; for cute: Fs < 1.44, ps > .233; for fun: Fs < 2.10, ps > .150; for exciting: Fs < 1.85, ps > .176; for playful: Fs < 2.31, ps > .131), indicating that the product designs in the four conditions were not different on any of these features. It is worth noting that the effects of anthropomorphism on attractiveness went in opposite directions for experiment 1B (a negative effect) and experiment 3A (a positive effect), but anthropomorphism did not affect product attractiveness in this experiment. Thus, the effect of anthropomorphism on preferences cannot be attributed to characteristics of product designs.

In the main study, participants were then asked to report their preferences between the two stereo speakers using the same two items used in experiment 2 along nine-point scales (after coding, 1 indicating preference for the dimension-dominant stereo speaker Aequitas and 9 for the absolute-dominant stereo speaker Canetis). Participants' responses to these items were averaged to form a preference index ($r = .70$, $p < .001$).

Then, to assess the way participants processed objects (i.e., the extent of using an integrated processing), we administered the 20-item version of the Gestalt Completion Task (GCT; Crawford 1981; Ekstrom et al. 1976; Förster, Friedman, and Liberman 2004). Specifically, participants viewed a series of fragmented pictures of familiar objects and were asked to perceptually integrate the fragments and

recognize the objects—that is, to close each Gestalt. Since the GCT requires participants to actively unify separate elements into a single and meaningful percept, performance on the GCT (the number of correctly identified images) served as a subtle proxy for integrated processing (Crawford 1981). Participants had five minutes to complete the task. Finally, as in previous experiments, participants completed a three-item manipulation check of product anthropomorphism ($\alpha = .86$) and the measures of involvement, effort, and affective state. In addition to the mood items measured in previous experiments, we also included a batch of short-lived affective state (i.e., excited, enthusiastic, inspired, nervous, and active) measures.

Results

Manipulation Check. As expected, participants perceived the stereo speakers as more human-like in the anthropomorphism condition ($M = 3.83$, SD = 1.85) than in the nonanthropomorphism condition ($M = 2.71$, SD = 1.37; $F(1, 81) = 9.89$, $p = .002$, $\eta^2_p = .11$). No significant effects of anthropomorphism were found on involvement ($F(1, 81) = .42$, $p = .520$), effort ($F(1, 81) = .21$, $p = .647$), or affective state (Fs < 1.29, ps $> .259$).

Stereo Speaker Preferences. Consistent with our expectation, the anthropomorphism manipulation had a significant effect on speaker preferences (see table 1), such that participants in the anthropomorphism condition preferred the absolute-dominant stereo speaker over the dimension-dominant stereo speaker to a greater extent ($M = 5.62$, SD = 1.34) than those in the nonanthropomorphism condition ($M = 4.79$, SD = 1.63; $F(1, 81) = 6.18$, $p = .013$, $\eta^2_p = .07$).

Integrated Processing and Mediation Analysis. We computed GCT scores by summing up the number of fragmented images (out of 20) correctly identified. As expected, participants in the anthropomorphism condition correctly identified a greater number of fragmented images ($M = 12.43$, SD = 2.09) than those in the nonanthropomorphism condition ($M = 10.93$, SD = 2.78; $F(1, 81) = 7.78$, $p = .007$, $\eta^2_p = .09$). To test the underlying mechanism, we conducted mediation analysis using the PROCESS macro developed by Hayes (2013, model 4). Bootstrapping involving 5,000 resamples from the data revealed that the effect of product anthropomorphism (1 = anthropomorphism, 0 = nonanthropomorphism) on participants' preferences was mediated by the proxy for integrated processing (performance in GCT; 95% CI [.0558, .6591]).

Discussion

The mediation analyses from experiments 3A and 3B, with two different measures of the mechanism (i.e., self-reported integrated perception and a subtle proxy for integrated processing—GCT, respectively), provide convergent evidence for the mediating role of the perception of each anthropomorphized product as an integrated entity. In the next experiment, we examine the moderating role of the motivation to seek maximized accuracy or ease.

EXPERIMENT 4: MODERATION BY MOTIVATION TO SEEK MAXIMIZED ACCURACY OR EASE

In experiment 4, we examined the effect of product anthropomorphism on preferences in situations in which consumers shift away from their normal good-enough criteria to seek either maximized accuracy or ease, since accuracy (ease) motivation has been shown to influence the usage of comparative judgment strategy (Creyer et al. 1990). Thus, we incorporated a motivation manipulation into our design. And we operationalized accuracy motivation as making an accurate decision without time constraint, and ease motivation as making a less effortful decision with time constraint (Creyer et al. 1990). This experiment had four motivation conditions: accuracy, time-constraint, good-enough, and baseline conditions. In the first two conditions, we let participants put more weight on accuracy (the time taken) than the time taken (accuracy) when making their decisions. In the good-enough condition, we let participants consider both the time taken and accuracy to make good-enough decisions. In the baseline condition, we did not give participants any instructions about their motivations.

We expected that, if people under normal circumstances indeed seek good-enough conclusions in making judgment about persons (and thus anthropomorphized products), then our previous findings would be replicated in both the baseline condition and the good-enough condition. In the accuracy condition, people are motivated to improve performance, which people believe can be achieved by exerting greater effort (Yates and Kulick 1977). Thus, people with such motivation are unlikely to use a less effortful strategy (e.g., calculating the number of superior dimensions), and thus should prefer the absolute-dominant alternative for both anthropomorphized and nonanthropomorphized products. Finally, time constraint should inhibit consumers' use of a more effortful absolute judgment strategy, leading to lower preference for the absolute-dominant alternative in both anthropomorphism and nonanthropomorphism conditions.

Method

Participants and Design. Three hundred twenty-seven undergraduate students (69.72% female, $M_{age} = 20.57$, SD = 1.58) participated in the study in exchange for a monetary reward. They were randomly assigned to conditions of a 2 (anthropomorphism vs. nonanthropomorphism) × 4

(time-constraint vs. accuracy vs. good-enough vs. baseline) between-subjects design.

Procedure. All participants were asked to do a product evaluation task. In the time-constraint, accuracy, and good-enough conditions, we manipulated participants' motivation by varying the task instructions, adopted from the method of Creyer et al. (1990). Participants were told that they were eligible to enter a HK$100 lottery if their performance exceeded a standard (in fact, all participants eventually entered into the lottery). To assess their performance, we told participants in the time-constraint condition that the time they took would be weighted three times as much as their accuracy and thus they should try to make a less effortful decision; those in the accuracy condition were told that the accuracy they achieved would be weighted three times as much as the time they took and thus they should try to make an accurate decision; in the good-enough condition, participants were instructed to consider both the accuracy achieved and the time taken and to make a good-enough decision. In the baseline condition, no such instruction was given to influence participants' motivation.

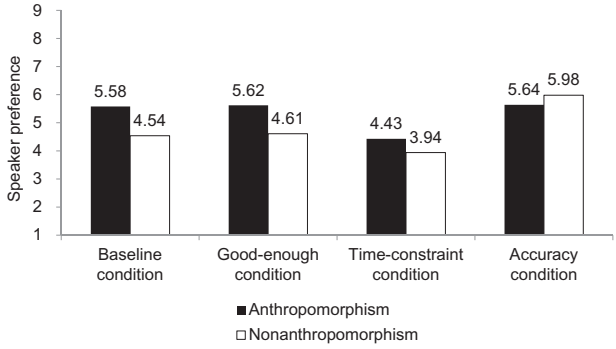
Participants were then given the same product stimuli to evaluate as in experiment 3B (a dimension-dominant stereo speaker and an absolute-dominant stereo speaker), either both anthropomorphized or both nonanthropomorphized. Then, as in previous experiments, participants reported their preferences using the same two items (after coding, 1 indicating the strongest preference for the dimension-dominant stereo speaker Aequitas, and 9 the strongest preference for the absolute-dominant stereo speaker Canetis; $r = .87$, $p < .001$), and completed the same three-item manipulation check for product anthropomorphism ($\alpha = .94$). As a manipulation check of motivation, participants also rated the nature of their motivation on a nine-point scale, with a higher value indicating motivation to maximize accuracy and a lower value indicating motivation to minimize the effort. Finally, participants completed the 20-item PANAS (Positive and Negative Affect Schedule) scale (Watson, Clark, and Tellegen 1988) as a measure of affective state.

Results

Manipulation Checks. Analyses of self-reported motivation revealed a significant main effect of motivation manipulation ($F(3, 319) = 8.09$, $p < .001$, $\eta^2_p = .07$). Specifically, while participants in the baseline condition ($M = 6.97$, SD = 1.61) and good-enough condition ($M = 6.80$, SD = 1.92) did not differ in terms of motivation ($F(1, 319) = .40$, $p = .527$), participants in both groups reported lower motivation to maximize accuracy than those in the accuracy condition ($M = 7.55$, SD = 1.64; $Fs > 3.94$, $ps < .048$, $\eta^2_p s > .01$), but higher accuracy motivation than those in the time-constraint condition ($M = 6.18$, SD = 1.97; $Fs > 4.87$, $ps < .028$, $\eta^2_p s > .02$). No other main effect or interaction effect was found for self-reported motivation ($ps > .519$). The manipulation of product anthropomorphism was also successful ($M_{anthropomorphism} = 3.88$, SD = 2.09 vs. $M_{nonanthropomorphism} = 2.80$, SD = 1.87; $F(1, 319) = 24.00$, $p < .001$, $\eta^2_p = .07$). No other main effect or interaction effect was found for perceived product anthropomorphism ($ps > .671$). Additionally, motivation manipulation, product anthropomorphism, and their interaction did not exert a significant effect on participants' affective state according to their responses on the PANAS (for positive affect: $Fs < 1.75$, $ps > .187$; for negative affect: $Fs < 1.28$, $ps > .280$).

FIGURE 1

PREFERENCE FOR THE ABSOLUTE-DOMINANT SPEAKER OVER THE DIMENSION-DOMINANT SPEAKER AS A FUNCTION OF MOTIVATION AND PRODUCT ANTHROPOMORPHISM: EXPERIMENT 4



Stereo Speaker Preferences. Analyses of participants' preferences revealed significant main effects for both motivation manipulation ($F(3, 319) = 9.77$, $p < .001$, $\eta^2_p = .08$) and product anthropomorphism ($F(1, 319) = 6.56$, $p = .011$, $\eta^2_p = .02$). Consistent with our prediction, these main effects were further qualified by their interaction effect ($F(3, 319) = 2.26$, $p = .082$, $\eta^2_p = .02$; see figure 1). Specifically, in the baseline condition, participants preferred the absolute-dominant stereo speaker over the dimension-dominant one to a greater extent when the stereo speakers were anthropomorphized ($M = 5.58$, SD = 2.01) than when they were nonanthropomorphized ($M = 4.54$, SD = 2.04; $F(1, 319) = 5.48$, $p = .020$, $\eta^2_p = .02$), replicating the results of previous experiments. The same effect also occurred in the good-enough condition ($M_{anthropomorphism} = 5.62$, SD = 1.61 vs. $M_{nonanthropomorphism} = 4.61$, SD = 2.20; $F(1, 319) = 5.62$, $p = .018$, $\eta^2_p = .02$).

However, all participants in the time-constraint condition preferred the dimension-dominant stereo speaker to a greater extent ($M_{anthropomorphism} = 4.43$, SD = 1.99 vs.

$M_{\text{nonanthropomorphism}} = 3.94$, SD = 2.00; $F(1, 319) = 1.32$, $p = .252$). In this case, it was the lowered preference for the absolute-dominant stereo speaker in the anthropomorphism condition that led to this null effect. The results were consistent with our expectations as well as previous research: time constraint encouraged participants to shorten their decision-making time and thus largely inhibited their use of a more effortful absolute judgment strategy, even for anthropomorphized products. And this also implies that although people naturally initiate integrated processing for human beings (and thus humanized products), such processing does not necessarily take less time to complete. That is why for both the anthropomorphism condition and the nonanthropomorphism condition, time constraint led to less use of an absolute judgment strategy.

In contrast, all participants with an accuracy motivation preferred the absolute-dominant stereo speaker to a greater extent, in both the anthropomorphism condition ($M = 5.64$, SD = 1.82) and the nonanthropomorphism condition ($M = 5.98$, SD = 1.87; $F(1, 319) = .63$, $p = .429$). The increased preference for the absolute-dominant product in the nonanthropomorphism condition may be caused by reliance on an absolute judgment strategy when participants had high motivation to maximize accuracy. According to Yates and Kulick (1977), the motivation to maximize accuracy drives people to improve performance, and people have the belief that greater effort does lead to better performance. Since an absolute strategy is characterized by a substantial amount of processing, people tend to use such a strategy when they are motivated to improve their performance (Creyer et al. 1990). And such an effect is well established in literature without considering anthropomorphism (Bettman et al. 1998; Creyer et al. 1990). We thus speculated that this accuracy motivation led to greater reliance on an absolute strategy, even in the nonanthropomorphism condition. However, it is also possible that these participants adopted compensatory dimensional processing, which could theoretically generate the same preference. In this regard, we acknowledge that this experiment was not intended to, and empirically cannot, differentiate between these two explanations for this particular accuracy × nonanthropomorphism condition. Such a differentiation could be further investigated in future research.

In short, the experiment is focused on how motivation (accuracy vs. ease) influences preference when products are anthropomorphized. And the findings showed good support for our main predictions.

Discussion

The findings in experiment 4 validated our assumption that under normal circumstances, when people form impressions of other persons (and thus, anthropomorphized products), they typically look for a good-enough conclusion and take both accuracy and effort into consideration. That is, the proposed effect of anthropomorphism on preferences found in the baseline condition was replicated in the good-enough condition. In addition, the results supported our hypothesis concerning the moderating role of motivation to maximize accuracy or ease. Participants with an accuracy (ease) motivation shifted away from the normal status of making good-enough decisions, and their preference for the absolute-dominant stereo speaker was greater (lower) regardless of the anthropomorphism manipulation.

In addition to the experiments described above, we conducted two other experiments, which are reported in web appendixes G and H, to further test possible boundary conditions. First, although forming overall impressions by integrating a person's attributes normally is a meaningful and effective way to make judgments, research on social stereotypes has shown that when the validity and effectiveness of using stereotypic information are made salient to people, they may instead rely on stereotypes to judge another person (Madon et al. 2006; Mcgarty, Yzerbyt, and Spears 2002). Here, the stereotype serves as a single piece of diagnostic information in judging the target person (Asch 1946; Mcgarty et al. 2002). Therefore, when the effectiveness of using stereotypes to judge a person is made salient, consumers may use a single piece of diagnostic information about the product in comparative judgments of anthropomorphized products. In the first experiment in the web appendix, we included diagnostic information in the product descriptions and found that when participants were reminded that using stereotypes was a good-enough strategy in personal impression formation, anthropomorphism increased participants' reliance on diagnostic information in comparing product alternatives and the effect of anthropomorphism on preference for an absolute-dominant alternative diminished. However, when participants were not reminded of the effectiveness of using stereotypes in person judgment, we replicated our previous findings.

Second, our conceptualization assumes that both the absolute judgment strategy and the dimension-by-dimension strategy can potentially be applied in comparative judgment. However, this might not always be the case. The information on product alternatives may differ in *alignability*, which refers to the degree to which alternatives are described or represented by the same set of attributes, and such differences may further influence consumers' choice strategies (Johnson 1984; Markman and Medin 1995). In our case, if the available dimensions along which the two alternatives are described are not all alignable (e.g., one alternative is described along dimensions I, II, and III, while the other is described along dimensions I, II, and IV), then these two alternatives cannot be readily compared dimension by dimension. In this case, whether the products are anthropomorphized or not, it is not meaningful to engage in dimension-by-dimension comparison.

However, it is still meaningful to employ the absolute judgment strategy. In the second experiment in the web appendix, we found that when the available dimensions of the two alternatives were not alignable, the preference for the absolute-dominant alternative increased for both anthropomorphism and nonanthropomorphism consideration sets; however, when the dimensions were alignable, the proposed difference in preference still occurred.

GENERAL DISCUSSION

Marketing practitioners frequently capitalize on imbuing their products with human-like elements (for a review, see Aggarwal and McGill 2017). Existing research has conducted in-depth analysis of the influences of anthropomorphism in marketing, yet has mainly focused on consumers' responses toward one specific anthropomorphized (vs. nonanthropomorphized) product in judgment and decision making. As product anthropomorphism has become even more popular recently, consumers may frequently encounter situations in which they directly compare two anthropomorphized products in the same category. The current research takes a novel perspective by showing that anthropomorphism will systematically influence consumers' decision-making process when comparing anthropomorphized product options in the same consideration set. Such a finding goes beyond the effects of anthropomorphism on judgment of each individual product, and reminds marketing practitioners that anthropomorphism may have unintended effects in a comparative judgment context.

Across six experiments in our article and two additional experiments in the web appendix, we present converging evidence showing that anthropomorphism increases the likelihood that consumers adopt an absolute judgment strategy over a dimension-by-dimension strategy in comparative judgment, and enhances consumers' preferences for an absolute-dominant product alternative over a dimension-dominant alternative. We found that the proposed effect was robust by directly tracing participants' information processing using MouseLab and eye tracking (experiments 1A and 1B), and through participants' self-reported preferences (experiments 2, 3B, 4, and two web appendix experiments) and real choices (experiment 3A). We varied the operationalization of anthropomorphism by presenting product alternatives with visual and verbal human-like descriptions together (experiments 1B and 3A), visual human-like descriptions only (experiment 3B and 4), and verbal human-like descriptions only (experiments 1A and 2), and also by having participants provide ratings on scales anchored with personality traits (two web appendix experiments). Our findings generalized to various product categories, including food (caramel corn snacks), electronic products (digital cameras, laptops, and stereo speakers), products associated with negative images (insecticide), and services (restaurant and tour package). Moreover, we demonstrated consumers' integrated perception of each anthropomorphized alternative to be the underlying mechanism by using both a self-reported measure (experiment 3A) and a subtler proxy for integrated processing (experiment 3B). Finally, we showed that the motivation to seek maximized accuracy or ease moderated the proposed difference in preference (experiment 4), and identified the effectiveness of using stereotypes in person judgment and the alignability of the product dimensions as two boundary conditions (two web appendix experiments).

While confirming our explanation of the proposed effect, we also tested several alternative interpretations to further clarify our conceptualization. First, the results from experiments 1A and 1B provide strong evidence that product anthropomorphism indeed influences how consumers process information when comparing humanized products, besides giving rise to a decision rule at the later stage of decision making. Second, the results of experiment 3B clearly show that the proposed effect was not due to participants' focus on the specific dimension with the biggest difference between the two options. Third, the similar amounts of time spent and eye fixation in experiment 1B and similar level of self-reported involvement and effort across conditions in the other experiments show that our findings could not be explained by the relative amount of attention and deliberation in comparison. Finally, across different experiments, we show that the effect could not be accounted for by alternative conceptualizations about other product design characteristics (e.g., attractiveness and cuteness) or positive affect.

The current research contributes to the anthropomorphism literature in several ways. First, prior research has mainly investigated consumers' responses to one specific humanized product itself (Aggarwal and McGill 2007; Chandler and Schwarz 2010; Chen et al. 2017; Hur et al. 2015; Puzakova et al. 2013). Our research takes a novel perspective by examining the effect of product anthropomorphism in the context of comparing two anthropomorphized alternatives simultaneously—a phenomenon that is pervasive in everyday consumption. Our study results show that product anthropomorphism systematically influences the comparative strategy consumers use to process product information in comparative judgment, and eventually determines their preferences. Thus, the present research supplements previous anthropomorphism literature and provides a more comprehensive perspective for analyzing the effects of anthropomorphism on consumers' product evaluation.

Second, researchers have previously proposed various mechanisms underlying the effects of anthropomorphism on consumers' judgments, with each conceptualization involving applying a specific aspect of human beliefs to a product (Aggarwal and McGill 2012). The current work provides new insights into this line of research by

introducing another fundamental aspect of human beliefs concerning how consumers perceive a humanized product. Specifically, similar to a human being, a humanized product is likely to be perceived as an integrated entity rather than a collection of separate attributes. Therefore, in a consideration set with two product alternatives directly comparable along several dimensions, using anthropomorphism in marketing communications will encourage consumers to focus on each product alternative as an integrated entity and to increase the use of an absolute judgment strategy.

Third, our research provides a comprehensive understanding for the effect of product anthropomorphism on comparative judgment strategy and preference by identifying some important boundary conditions of the effect. We demonstrate that the rationale behind the proposed effect is employing an absolute judgment strategy to make a meaningful and good-enough decision. When the motivation to seek maximized accuracy (ease) is activated, however, consumers may shift away from their normal good-enough criteria, and then be more likely to use an absolute (dimension) strategy both for anthropomorphized products and for nonanthropomorphized products. Relatedly, when the effectiveness of using another strategy (e.g., relying on stereotypes in person judgment) to make a meaningful decision is made salient, consumers may not rely more on an absolute judgment strategy in comparing anthropomorphized products. Moreover, when the dimension-by-dimension comparison does not make sense (e.g., the dimensions of the product alternatives are not alignable), consumers may rely more on an absolute judgment strategy even when comparing nonanthropomorphized products.

Our research also contributes to the literature on comparative judgment by revealing a new mechanism that drives the selection of certain comparative strategies. While a substantial amount of previous research has identified the antecedents of comparative judgment strategies, such as effort minimization/accuracy maximization motivation (Luce et al. 1997), the learning/choosing goals of processing (Biehal and Chakravarti 1982), and task-related emotion (Bettman et al. 1998), these factors mostly relate to consumers' high or low level of deliberation associated with judgment of the alternatives. Over and above the existing conceptualization concerning the degree of deliberation, the present research identifies a new mechanism through which consumers consider each anthropomorphized product as an integrated entity rather than a collection of separate attributes, and are more likely to use an absolute judgment strategy in comparative judgment. Importantly, our studies show that consumers engage in the same levels of deliberation across anthropomorphism and nonanthropomorphism conditions but differ in the strategies that they employ.

By manipulating product anthropomorphism using various approaches and by showing the robust effect of anthropomorphism on consumers' comparative judgments in different paradigms, our findings provide strong managerially actionable implications for marketers, suggesting product anthropomorphism as one additional and feasible way for firms to exert influence on consumers' comparative judgments. Nowadays, the rapid growth of online shopping platforms has provided consumers with unparalleled opportunities to compare product offerings efficiently (Häubl and Trifts 2000). At the same time, product anthropomorphism has been widely used in marketing practice (Aggarwal and McGill 2017; Kim et al. 2016). In such situations, product anthropomorphism might have unintended consequences of which practitioners are not fully aware. As implied by our findings, product anthropomorphism can exert influences over and above established effects on judgment of each individual product. That is, it will systematically influence the comparative judgment strategies consumers employ when comparing two anthropomorphized (vs. nonanthropomorphized) product options. To this extent, our findings enrich marketing practitioners' knowledge about the outcomes that product anthropomorphism may bring as a marketing tactic. The current research may also provide insights regarding a major managerial question in such a context: should a firm anthropomorphize its products involved in comparative judgments, especially when a key competitor has already adopted the anthropomorphism tactic? Our findings indicate that the answer depends on whether the firm's product is strong in terms of overall evaluation or is superior along multiple dimensions. Although anthropomorphizing should benefit a firm's product in comparative judgment when the target product is evaluated favorably as a whole, this tactic may backfire when the target product is favorable on many dimensions but does not have an outstanding overall rating. Thus, using product anthropomorphism does not always lead to a better outcome than not doing so, and brands/retailers with products characterized by inferior overall favorableness need to think twice before engaging in marketing communications utilizing product anthropomorphism.

The results reported herein are also thought-provoking. First, in order to provide more straightforward empirical evidence, our research considers comparisons between a pair of products. Further research is needed to more systematically examine the proposed effect by considering comparative judgments involving three or more options. Second, while the present research focuses on comparative strategies and preferences with two anthropomorphized products, it would be interesting to investigate the strategy used when consumers compare one anthropomorphized product and another nonanthropomorphized product, which represents another pervasive situation that consumers may often encounter. In such a situation, while the anthropomorphized product is perceived as an integrated entity, which potentially leads to an absolute judgment strategy, the nonanthropomorphized product may be perceived as a bundle of separate attributes, most likely leading to a

dimension-by-dimension strategy. Then, which strategy or combination of strategies is used might depend on other factors such as motivations and displays of product information. It would be worth investigating which comparative strategy would be dominant in different cases. Third, as mentioned earlier, besides focusing on the total number of superior dimensions (i.e., a noncompensatory way of applying a dimension-based strategy), previous research also documents a compensatory way to apply such a strategy, which also considers the relative sizes of the superiority when comparing dimensions (Russo and Dosher 1983). The noncompensatory way is more likely to be used in normal situations because it reduces computational effort (Russo and Dosher 1983), which is consistent with the findings about participants' product preference and choice in our experiments. But there should be situations in which consumers use the dimension strategy in a compensatory way rather than counting the number of superior dimensions. Future research on this issue may be worthwhile.

Finally, some limitations in our stimuli design should be noted. In experiments 2–4, we designed the stimuli attributes to have equal weights to make consumers concentrate on the manipulation of key constructs that are of primary relevance to our conceptualization. Although the MouseLab study (experiment 1A) and eye-tracking study (experiment 1B) both supported our hypothesis without such an equal-weights assumption, we do think our effects on stimuli with more complex assignments of attribute weights are worth further investigation, especially for the preference and choice measures. And the present research adopted the tabular format of product information presentation following the literature on processing strategies (Luce et al. 1997; Russo and Dosher 1983). This format was used to give participants comparable opportunities to process product information either by alternatives (to process information along columns) or by dimensions (to process information along rows). In fact, previous research has shown that simply varying information-presentation format (e.g., organized by alternative or by dimension) may bias consumers' processing strategy (Biehal and Chakravarti 1982). While we followed the tabular format to ensure that consumers' comparative judgment strategies were not biased by the organization of information, further research may explore new formats in studying processing strategies.

DATA COLLECTION INFORMATION

Experiments 1A, 3A, and 3B were conducted at the Chinese University of Hong Kong from October 2015 to September 2017 by the first and the second authors under the supervision of the third author. Experiments 1B and 4 were conducted at the University of Hong Kong in December 2016 and March 2018 by a research assistant under the supervision of all three authors. Experiment 2, web appendix experiment 5, and web appendix experiment 6 were conducted on MTurk from April 2015 to September 2017. All authors jointly analyzed and discussed the data.

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