Facing Dominance: Anthropomorphism and the Effect of Product Face Ratio on Consumer Preference

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A product's front face (e.g., a watch face or car front) is typically the first point of contact and a key determinant of a consumer's initial impression about the product. Drawing on evolutionary accounts of human face perception suggesting that the face width-to-height ratio (*f*WHR: bizygomatic width divided by upper-face height) can signal dominance and affect its overall evaluation, this research is based on the premise that product faces are perceived in much the same way as human faces. Five experiments tested this premise. Results suggest that like human faces, product faces with high (vs. low) *f*WHR are perceived as more dominant. However, while human faces with high *f*WHR are liked less, product faces with high *f*WHR are liked more as revealed by consumer preference and willingness-to-pay scores. The greater preference for the high *f*WHR product faces is motivated by the consumers' desire to enhance and signal their own dominant status as evidenced by the moderating effects of type of goal and of usage context. Brand managers and product designers may be particularly interested in these findings since a simple design feature can have potentially significant marketplace impact, as was also confirmed by the field data obtained from secondary sources.

Keywords: dominance, power, product anthropomorphism, face ratio, face perception, product faces, evolutionary psychology

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Imagine that you are driving on a highway and an automobile is tailgating you. When you glance in the mirror, the car behind you looks menacing, as if it has an angry face. Would you feel intimidated and change lanes to let this car pass you? Would you feel and act differently if the car behind you had a friendly "smile" and was pleasant-looking? Alternatively, if you were the person driving the mean-looking car, would you feel more empowered and be inclined to act like a bully on the road?

Anecdotally speaking, people believe that the way a product looks says a lot about its owner. A smiling car might signal that the owner is nice and friendly, whereas a mean-looking car might suggest that the owner is aggressive and arrogant, telling others to "get out of my way" (Baruth 2014). It is not surprising, then, that automobile buyers place a lot of emphasis on the front "face" of the car, such that about 88% of men and 64% of women prefer cars with distinctive front ends (Welsh 2006). A question of both theoretical and practical importance is what exactly

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do different car faces signal? More generally, do consumers perceive product faces the same way they perceive human faces? If so, since people often infer others' personality traits from their faces, do they also infer product personality traits from product faces? Is the association of specific product traits with the structure and shape of product faces similar to the association of traits with human facial structure and shape? How might these associations influence consumers' overall evaluation of the product itself?

A product's face and overall appearance are typically the first points of contact with consumers, offering a key opportunity for impression formation (Hollins and Pugh 1990). Visual aesthetics of product design—materials, proportion, color, shape, size—have been recognized as a source of sustainable competitive advantage for products (Lawson 1983). For example, Veryzer and Hutchinson (1998) found that unity and prototypical elements of a product design significantly influence consumer preferences. Generally speaking, good design has been shown to improve brand strength and quality perceptions (Berkowitz 1987). Further, product shape and form influence the user's emotional experience, product evaluations, and purchase intentions (Creusen and Schoormans 2005). Indeed, recent research demonstrates that aesthetics bestow a "beauty premium" on products because they allow people to affirm their sense of self (Townsend and Sood 2012). Within this rich body of literature on product design, most previous research explores the general idea of a beauty premium rather than the ways in which a product's looks can convey meaning about specific traits. The current research aims to fill this gap. In particular, we propose that specific features of a product's face can signal the trait of dominance, which in turn influences consumers' preference for that product.

Extant research suggests that products that are morphologically similar to human faces (e.g., car fronts) are perceived and processed like human faces. For example, using an eye-tracking method, Windhager et al. (2010) showed that people process car headlights like eyes and the car grille like a human mouth. Our research builds on this work by proposing a very simple feature of product design that influences consumer perception of the product personality. In particular, drawing upon evolutionary accounts of human face perception suggesting that the face width-to-height ratio (*f*WHR: bizygomatic width divided by upper-face height) can signal dominance (Lefevre et al. 2013), we examine whether the width-to-height ratio of a product face also signals the dominance trait of the product, and if this in turn affects the overall evaluation of the product.

Defining social dominance as the ability of an individual or group to control others' behavior primarily in competitive situations (Rowell 1974), we suggest that much like human faces, products with high *f*WHR faces are perceived as being high on dominance. However, unlike the interpersonal domain where dominant-looking faces are liked less, the higher perceived dominance of a product leads to a greater preference and a higher willingness to pay (WTP) for it. We surmise that in an interpersonal context, a dominant-looking person is often seen as an adversary; in contrast, consumers use a dominant-looking product as a means to enhance their own perceived dominance by integrating the personality trait of the product with their own, and consequently they like such a product more rather than less. Furthermore, prior work suggests that goals determine the selection of goal-relevant schemas, which, in turn, influence the observer's processing of the information and the overall evaluation (Cohen and Ebbesen 1979). Consequently, we argue that a conflicting goal such as a desire to affiliate (rather than dominate) will suppress dominance perception and valuation of products with high *f*WHR. This novel research contributes to extant literature on identity signaling and compensatory consumption by underscoring the influence of product design in general and product face ratio in particular, as well as to research on product anthropomorphism by highlighting the implications of processing product faces like human faces.

DOMINANCE: PERCEPTION AND EVALUATION

According to Weber (1947/1978), social stratification results from the interaction of three primary components: wealth, prestige, and power. Wealth includes properties and assets. It also refers to "class," which indicates a person's economic position in a society. Prestige indicates one's relative social position as perceived by others. It is also called status, and refers to a person's social honor, or popularity in a society. Although modern society considers occupation as a key indicator of prestige, in ancient society prestige was more related to wealth. Power refers to the ability to achieve goals despite the will of others. It is defined as "the probability that one actor within a social relationship will be in a position to carry out his own will despite resistance, regardless of the basis on which this possibility rests" (Weber 1947, 152). While prestige (or status) and power might sometimes coexist, they are independent constructs: "power can occur without prestige, and prestige without power. Albert Einstein, for example, has prestige but no power in any significant sociological sense of the word. A policeman has power but little prestige" (Bierstedt 1950, 731). A closely related concept to power is dominance, which is the ability to make others' behavior conform to one's commands (Weber 1978). Here we use the terms "status" and "prestige" for social status—that is, for relative ranking in a social hierarchy—and "power" and "dominance" to refer to one's authority or control over others.

Dominance is theorized to have arisen in evolutionary history as a result of antagonistic contests for resources, common among both nonhuman species and prehuman ancestors. Studies show that we evolved from an

egalitarian hunter-gatherer society to a nonegalitarian ranked society, and ownership of resources by aggressive, competitive individuals could have boosted inequality (Arnold 1993; Pringle 2014). Among contemporary societies, people often use intimidation and coercion by control over costs and benefits to establish or maintain a dominance hierarchy shaped by subordination (Cheng et al. 2013). Social dominance situations in which an individual controls others' behavior (Rowell 1974) have been suggested as illustrating one of the most basic human motives (Adler 1930; Mazur 1983). In fact, the dominance motive may even have a genetic basis in both nonhuman primates and humans (Schmalt and Heckhausen 1988).

The Role of Facial Cues in Dominance Signaling

Facial morphology is believed to be part of an evolved mechanism to help maintain dominance relationships. Animal research shows that most group-living animals' facial signals (expression and morphology) correspond to their position in a dominance hierarchy (Mazur 2005). Other studies show that people accurately read trait signals from stable facial cues within 100 milliseconds of encountering a face (Todorov et al. 2005), and that dominance is one of the most fundamental dimensions of trait inferences made from static facial cues, along with valence or trustworthiness (Forgas, Fiedler, and Sedikides 2012; Oosterhof and Todorov 2008). Whereas valence evaluation is an overgeneralization of the perception of a person's intentions and whether to approach or avoid a person, dominance evaluation is an overgeneralization of the person's ability to implement these intentions and their probable success or failure during competitive interactions with others (Keating and Doyle 2002; Keating, Mazur, and Segall 1977).

Accordingly, evolutionary psychologists suggest that the human perceptual system evolved over time to be extremely sensitive to dominance cues from others (McArthur and Baron 1983). Dominance is perceived from emotional expressions as well as static facial cues. For instance, baby faces are perceived as weak (Zebrowitz and Montepare 1989), angry faces are perceived as highly dominant, and sad and fearful faces as low in dominance (Montepare and Dobish 2003). Small eyes and a nonsmiling face are perceived as indicators of dominance (Keating 1985). More recent findings show that faces with higher width-to-height ratio (*f*WHR) are seen as more dominant and aggressive. Although higher *f*WHR is sometimes associated with positive behaviors such as striving for achievement (Lewis, Lefevre, and Bates 2012), high-ratio faces are generally seen as less likeable (Stirrat and Perrett 2010) because individuals with a high *f*WHR tend to exhibit aggression (Carré, McCormick, and Mondloch 2009), deception (Haselhuhn and Wong 2012), and breach of trust (Stirrat and Perret 2010).

In contrast to these negative evaluations of high *f*WHR faces, another body of research suggests that people with high *f*WHR faces are perceived as more suitable for leadership positions and indeed tend to achieve high social rank. Perceived dominance is seen as an aspect of perceived competence, and perceived competence is the predictor of achieving a leadership position (Todorov et al. 2005). Indeed, perceived power but not perceived warmth predicted success in US elections (Rule et al. 2010), and individuals with dominant faces were elected as leaders more in war times than in peace times (Little et al. 2007). Consistent with these findings, research shows that many institutions still associate dominant-looking faces with high-ranked positions (Mazur, Mazur, and Keating 1984). For instance, US presidents have higher *f*WHR compared to average people, and a significant positive association was found between *f*WHR and achievement drive, and a negative association between *f*WHR and "poise and polish" (Lewis et al. 2012). CEOs with a higher *f*WHR are more successful, delivering higher return on investment for their firms (Wong, Ormiston, and Haselhuhn 2011). Furthermore, *f*WHR has been found to correlate positively with professional athletes' performance (Tsujimura and Banissy 2013).

Because *f*WHR is one of the most prominent human secondary sexual characteristics, testosterone levels have been identified as a common underlying factor linking *f*WHR to dominant behavior (Lefevre et al. 2013; Mazur 2005). Testosterone influences the development of both the physique and the central nervous system as part of sexual differentiation during adolescence, stimulating growth of the jaw, cheekbones, brow ridges, and center of the face from brow to bottom of the nose (Carré and McCormick 2008). This facial morphology has been postulated to signal health and immunocompetence, and thus helps maintain dominance relationships (Thornhill and Gangestad 1999). While no association has been found between testosterone levels and other facial metrics including perceived facial masculinity, evidence suggests a link between testosterone levels and *f*WHR (Peters, Simmons, and Rhodes 2008). Not surprisingly, studies show that females prefer men with high *f*WHR for short-term dating although not for long-term relationships (Valentine et al. 2014). Furthermore, a positive relationship between testosterone and aggression occurs primarily in situations where males are competing with other males or when the status of a male is challenged (Archer 2006; Mazur 1983). Although a number of past studies have been conducted with male populations, recent evidence suggests that the positive relationship between *f*WHR and aggressive behaviors can be found in both men and women (Lefevre et al. 2014). In particular, a recent meta-analysis revealed that high *f*WHR faces from both genders are perceived as highly dominant and threatening (Geniole et al. 2015).

Products as Instruments for Acquisition of Dominance and Power

Neuroscientific evidence suggests that people have an innate ability to detect human faces, including objects that only resemble human faces (Tong et al. 2000). The human fusiform face area, the part of the human brain that processes human faces, is involved in some aspects of the perceptual analysis of faces, like the detection of a face as an image or the structural encoding of the information necessary for face recognition, such as the eyes, nose, and mouth. The fusiform face area is not specifically tuned only to human faces; it also responds more broadly to humanlike faces (Erk et al. 2002; Kanwisher and Moscovitch 2000). Likewise, studies show that robots that resemble human faces evoke automatic perceptions of a person. For example, people attribute personality traits to a computer's face-display interface more than to a text-display interface, and they are also more aroused and present themselves in a more positive light when interacting with face-display interfaces (Power, Wills, and Hall 2002; Sproull et al. 1996).

Not only is a product face perceived in the same manner as a human face, a product is often used as a tool for self-completion. Consistent with Belk's (1988) notion of self in which "we regard our possessions as part of ourselves" (139), much subsequent research indicates that people tend to include owned objects in their cognitive representation of the self (Aron et al. 1991). The act of choosing can convey identity-relevant information because people often use product and brand choice to construct a desired identity for themselves and to communicate it to others (Bodner and Prelec 2003). For example, consumers tend to gravitate toward purchasing unnecessary luxuries to display their wealth and power (Mandel, Petrova, and Cialdini 2006; Nelissen and Meijers 2011; Rucker and Galinsky 2008; Veblen 1899/1994); use relative size of choice options as a power-signaling device (Dubois, Rucker, and Galinsky 2012); and engage in nonconforming behaviors, such as wearing red sneakers in a professional environment or gym clothes to a luxury boutique, as signals of conspicuous consumption and power (Bellezza, Gino, and Keinan 2014). However, such prior research has not investigated the relationship between product shape—in particular product face ratio—and dominance/power signaling. Thus, in this research, we propose that a high *f* WHR of product face leads to an attribution of high-dominance characteristics to the product, much in the same way that human faces with high *f* WHR are rated high on dominance traits. Formally stated,

> **H1a:** Both human and product faces with high (vs. low) *f* WHR will be perceived as being high on dominance traits.

It is commonly assumed that an object capable of satisfying a need will be perceived as subjectively more valuable (Brendl and Higgins 1996). Animal research shows that social dominance is related to the dopaminergic reward system such that being in a subordinate position can cause disruption in this system (Morgan et al. 2002; Schultz 2010; Wilson et al. 2008). Not surprisingly, human research also shows that power-signaling items are strong social reinforcers and are highly rewarding. Neurological evidence supports the prediction that power-signaling products are highly valued, indicated by the fact that reward mechanisms (e.g., acquiring food) are involved in the regulation of dominance and social rank. Indeed, dominant-looking automobiles activate the dopaminergic reward circuitry (Erk et al. 2002). Hence, it is likely that dominant-looking products help consumers feel more empowered themselves, leading them to prefer such products and be willing to pay more for them. Thus, we predict that, unlike people with high *f* WHR who are evaluated less positively than those with low *f* WHR, a product with high *f* WHR will be evaluated more rather than less positively. Specifically,

> **H1b:** Human faces with high (vs. low) *f* WHR will be evaluated less positively, while product faces with high (vs. low) *f* WHR will be evaluated more positively.

A number of previous studies show that contextual and motivational factors such as current needs and goals can shape and bias perceptual processes by enhancing or inhibiting sensitivity to cues that signal characteristics that function as a means to achieve the activated goal (Bruner and Minturn 1955). For example, hungry individuals are more likely to see food in ambiguous images (Levine, Chein, and Murphy 1942), and thirsty people respond more rapidly to goal-relevant products such as water (Ferguson and Bargh 2004). In the context of face perception, research shows that person perception is not only driven by bottom-up facial cues but also constrained by top-down social cognitive processes (Freeman and Ambady 2011). In other words, social perceptions emerge from the continuous interaction between lower-level sensory processing (e.g., facial cues) and higher-order social cognition (e.g., stereotypes, goals); and the interrelations between cues and higher-order states (goals) determine social judgments. Recent work reveals that this social-conceptual knowledge can even bias visual perception. For example, when computer-generated faces were presented in multiple social categories, people tended to represent them in terms of fluent categories (black-aggressive-male) versus disfluent categories (black-happy-female), resulting in biased visual perception of faces (Stolier and Freeman 2016). Other research in this area has looked at the effect of relevant versus irrelevant goal salience on face perception. Thus, Maner et al. (2005) found that when participants were primed with a self-preservation goal, black faces and Arab faces were perceived as being more angry and threatening; however, when a mate-selection goal was activated, participants associated opposite-sex faces with greater sexual

arousal. These studies thus suggest that contextual factors like social categorization and salient goals can influence people's perception of human faces and their overall evaluations.

Given that human face perception is subject to contextual factors, we surmise that the particular circumstance is likely to influence people's perception of product faces as well. We employ this insight to examine a number of moderating factors that might aggravate or alleviate the effect of product face ratio on perceived dominance and evaluations. To elaborate, people will evaluate a product with high *f*WHR more positively when the product is perceived as a part of the self-identity (e.g., belonging to an in-group member) compared to when it is perceived as being distinct from the self (e.g., belonging to an out-group member).

> **H2a:** When evaluating a product (person) face belonging to an out-group (in-group) member, the effect of face-ratio will be significantly weaker.

Further, a salient dominance goal will aggravate and a salient nondominance goal (e.g., affiliation goal) will alleviate people's sensitivity to "read" dominance traits from (product) facial cues, and this perception will drive the valuation of and preferences for the product.

> **H2b:** When a dominance goal (vs. an affiliation goal) is activated, the effect of product face ratio will be significantly stronger.

Finally, when the product consumption context is such that the perceived advantage of signaling dominance is particularly high or salient (e.g., a public consumption context), the perceived value of a dominant product might be significantly greater than a context when there is little or no perceived advantage of signaling dominance (e.g., private consumption contexts).

> **H2c:** When consumption context is public (vs. private), the effect of product face ratio will be significantly stronger.

We tested these hypotheses in five studies. Study 1 provides initial evidence in support of our proposed effect that evaluation of high *f*WHR product faces differs from that of high *f*WHR human faces in that people evaluate high *f*WHR products more rather than less positively. This study also finds process evidence showing that the effects of *f*WHR on preferences are mediated by perceived dominance. Study 2 sheds more light on the underlying mechanism by identifying a moderator of the effect—social categorization of the person owning the product as being a member of one's in-group versus out-group (i.e., perceived closeness). Study 3 manipulates the consumption goal more directly to show that the effects of *f*WHR on perceived dominance and preferences are suppressed when the activated goal is inconsistent with dominance. Study 4 replicates the effect of goal by a more subtle manipulation—changing the context of the product usage from public to private. Finally, study 5 distinguishes between dominance and prestige to show that the effect is observed when a dominance goal but not when a prestige goal is salient. Across these five studies we consistently find support for our premise that *f*WHR of product faces affects the perceived dominance of the product, which in turn affects its overall evaluation.

STUDY 1: EFFECT OF RATIO ON PREFERENCE FOR HUMAN AND PRODUCT FACES AND THE MEDIATING ROLE OF PERCEIVED DOMINANCE

The purpose of study 1 was to test if product faces are perceived like human faces, such that products with higher *f*WHR are associated with greater perceived dominance. This study further examines if, unlike human faces, product faces with high *f*WHR are preferred over those with a lower *f*WHR, and if perceived dominance mediates these evaluations.

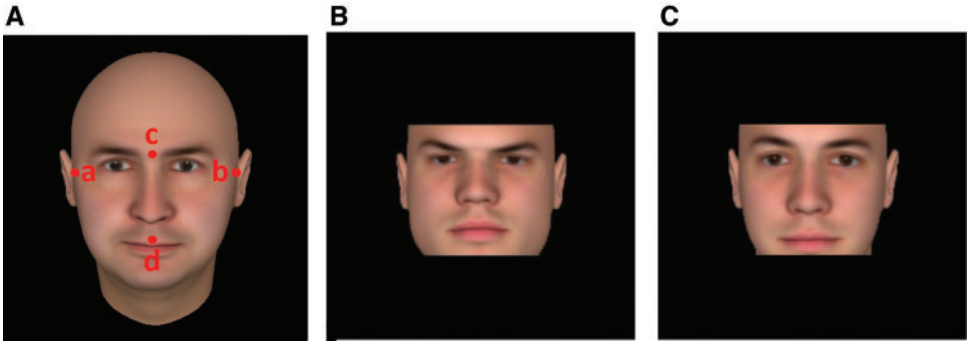
Method

Human and Product Face Stimuli. Four computer-generated human faces were manipulated on width-to-height ratio with FaceGen modeler, such that the upper lip–to–midbrow metric for each was changed to generate images with three different ratios (e.g., high ratio: 2.13 vs. medium ratio: 1.9 vs. low ratio: 1.7), yielding a total of 12 human-face stimuli. Using Adobe Photoshop, we manipulated four automobile face images to generate three levels of width-to-height ratio (e.g., high ratio: 2.08 vs. medium ratio: 1.73 vs. low ratio: 1.54), yielding a total of 12 automobile faces. All images were produced in 400 × 400 pixels with a 72 pixels/inch resolution throughout all studies (see figure 1).

Participants and Design. Two hundred forty-eight individuals (105 female; 187 Caucasian; age range 18 to 72) from an online panel participated in this two-part (presumably unrelated) study for payment. Participants were told that the first part of the study was about how individuals make snap judgments of a person's face. They were randomly exposed to one of 12 human faces, presented in a horizontal window to eliminate any potential influence of hair or outfit. Participants were then told about the second part of the study, where they were asked to evaluate one newly developed product from a variety of categories. In actuality, all participants were randomly presented with one of 12 automobile faces. They were told that the horizontal window was intended to eliminate any influence of the background.

FIGURE 1

STIMULI EXAMPLES (STUDIES 1 AND 2)



Measuring points used for morphometric calculations and examples of high- and low-ratio faces. Panel (A): Measure of *f*WHR: a–b represents the maximum distance between the left and right facial boundaries (bizygomatic width); c–d represents the upper lip and highest point of the eyelids (upper-face height). *f*WHR was calculated as width divided by height (a–b / c–d). Panel (B): Example of high-ratio face (*f*WHR = 2.13). Panel (C): Example of low-ratio face (*f*WHR = 1.70). The face images were created using FaceGen Modeler 3.5 (Singular Inversions, www.facegen.com). Reproduced with permission.

STIMULI EXAMPLES (STUDIES 1, 2, AND 3)

Measuring points used for morphometric calculations and examples of high- and low-ratio automobile faces. Panel (A): Measure of *f*WHR: automobile *f*WHR was calculated as width divided by height (a–b / c–d). Panel (B): Example of high-ratio automobile face (*f*WHR = 2.28). Panel (C): Example of low-ratio automobile face (*f*WHR = 1.43). The car face images are representations of the experimental stimuli for illustrative purposes only (image source: pixabay.com). The actual stimuli used for the experiments are available from the authors.

Dependent Measures. All participants were asked to provide their assessment of the perceived dominance of the presented stimuli (separately for the human and product faces) on three items (powerfulness, aggressiveness, and submissiveness [reverse-scored]; 1 = not at all, 7 = extremely). Next, participants provided preference ratings for the face stimuli using two items (liking and positive evaluation; 1 = not at all, 7 = extremely). Finally, participants' demographic information, such as gender, ethnicity, and household income, was collected. No effect of demographic variables was found, so this will not be discussed further.

Results and Discussion

Given that the three different face ratios for the human and product faces were randomized for each participant, we performed a linear mixed-effects analysis using lme4 (Bates et al. 2015) and lmerTest (Kuznetsova, Brockhoff, and Christensen 2016) available from R (R Core Team 2016) to test the relationship between *f*WHR and perceived dominance and preferences for both human and product faces. As fixed effects, we entered into the model *f*WHR and face type (human vs. product) and an interaction term between the two. As random effects, we had intercepts for subjects and face identities for each face

type: person and product, and slopes for each face type nested within subject. This model allows us to generalize our findings to the whole population of person and car faces by accounting for the fact that the stimuli were sampled out of the population of human faces and car faces, respectively (Westfall, Kenny, and Judd 2014). The effects of *f*WHR and face type on dominance and preferences were estimated in a separate model. Residual plots did not reveal any obvious deviations from homoscedasticity or normality. Significant levels were obtained by likelihood ratio tests of the full model with the effect of *f*WHR against the model without the effect of *f*WHR.

Perceived Dominance. Results of random effects show less variability in the perceived dominance measure for the human faces compared to the product faces, indicating that perceptions of dominance from human faces are more consistent across individuals than dominance perceptions from product faces. However, residual variance indicates that only an extremely small portion of variability was explained by face type (person vs. product), with most variations in dominance evaluation not accounted for by the face type. Fixed-effects results indicate that, compared to a high-ratio person face ($\gamma_{00} = 5.39$), both medium-ratio ($\gamma_{02} = -1.06$, $t(242) = -6.38$, $p < .001$; $M = 4.34$) and low-ratio person faces ($\gamma_{01} = -2.16$, $t(242) = -12.74$, $p < .001$; $M = 3.23$) are perceived as less dominant. Similarly, the high-ratio product face is perceived as equally dominant as the high-ratio person face ($\gamma_{10} = -.63$, NS; $M = 4.76$) and more dominant compared to both medium-ratio ($\gamma_{12} = .76$, $t(484) = 3.22$, $p < .01$; $M = 4.46$) and low-ratio product faces ($\gamma_{11} = 1.68$, $t(484) = 7.06$, $p < .001$; $M = 4.28$). Likelihood ratio tests of the full model against the model without the ratio term (the null model) turned out significant ($\chi^2(4) = 148.06$, $p < .001$), indicating that ratio indeed increases perceived dominance, and there are no human–product face-type differences in terms of dominance perception ($F < 1$). Finally, through both AIC and BIC tests, the full model showed better fit (140 decreases in AIC; 123 decreases in BIC), indicating that contribution of ratio to the model is significant.

Preferences. Similar to the dominance perception, results of random effects on preference index show more variability in the liking measure for product faces compared to human faces, indicating that individuals' preferences for product faces are more idiosyncratic. Fixed-effects results show that, compared to a high-ratio human face ($\gamma_{00} = 3.09$), both medium-ratio ($\gamma_{02} = .93$, $t(244) = 5.74$, $p < .001$; $M = 4.02$) and low-ratio human faces ($\gamma_{01} = 1.01$, $t(244) = 6.11$, $p < .001$; $M = 4.11$) are significantly more preferred. However, when it comes to product faces, a high-ratio product face is much more liked ($\gamma_{10} = 1.44$, $t(5) = 4.56$, $p < .01$; $M = 4.53$) compared to both medium-ratio ($\gamma_{12} = -1.33$, $t(443) = -4.85$, $p < .001$; $M = 4.13$) and low-ratio product faces ($\gamma_{11} = -1.44$, $t(448) = -5.18$, $p < .001$; $M = 4.11$). This indicates that increases of ratio in human faces decrease liking, while increases of ratio in product faces increase liking. Further testing confirms that face ratio ($F(2, 444) = 23.27$, $p < .001$) and the interaction between face type and ratio ($F(2, 444) = 16.74$, $p < .001$) significantly influence the preferences index. We examined the model fit using AIC and BIC tests. Compared to the null model, the full model shows better fit (39 decreases in AIC; 23 decreases in BIC), indicating that contribution of ratio to the model is significant. Finally, likelihood ratio tests of the full model against the null turned out significant ($\chi^2(4) = 47.38$, $p < .001$), indicating that ratio indeed increases preferences.

Mediation Analyses. For insight into the underlying mechanism, we examined if dominance mediated the effect of face ratio on preferences following the procedure by Hayes (2012, model 4). Because face stimuli were presented in three levels of *f*WHR and each participant saw different *f*WHR of products and humans, the ratio factor could not be dummy-coded. Thus, multilevel mediation analyses were not performed. Instead, only high- and low-ratio automobile faces were included in the model (dummy codes: 1 = high, 0 = low). Using 5,000 bootstrap samples, this analysis revealed a significant indirect effect of ratio on preference for product faces ($\beta = .49$, $p < .02$) through dominance ratings ($\beta = .55$, $p < .001$) with a 95% confidence interval, excluding zero (95% CI: .076 and .507). Specifically, when dominance ratings were included in the regression, the direct effect of ratio on preference became nonsignificant ($\beta = .11$, NS), confirming our thesis that perceived dominance drives the effect of face ratio on preference for the automobiles.

These results support our prediction that high-ratio faces, both human and product, tend to be perceived as highly dominant. However, unlike with the human face, higher perceived dominance of a product face leads to more positive evaluations. This is an interesting finding in that it highlights a significant difference in the way anthropomorphized product faces are evaluated compared to human faces, leading to the next question: What drives these differences in preference? To answer this question, study 2 tests whether group membership of the person—in-group versus out-group—associated with the face moderates the effects found in study 1.

STUDY 2: THE ROLE OF IN-GROUP VERSUS OUT-GROUP MEMBERSHIP

Human history has been characterized in part by frequent intergroup conflict over limited resources, and this tribal warfare is ubiquitous across cultures (Tooby and

Cosmides 1988). In fact, such universality of intergroup conflict has been suggested as being rooted in biology (Kurzban and Neuberg 2005). Consequently, when a human face is perceived as that of a "close other" (i.e., an ally) rather than of an adversary, the negative effect of perceived dominance on evaluation should dissipate. In the same vein, a dominant-looking product owned by an out-group person will not be evaluated as positively as one owned by an in-group member since a product instrumental in boosting the relative power of an out-group person would not advance one's own dominance position. Thus, we predict that when a face is presented as that of a person from one's in-group (vs. out-group), and because an in-group person is rarely threatening, a high-ratio in-group face will not be evaluated negatively, whereas the same face presented as out-group will be liked less. Further, evaluation of product faces will also exhibit a group-membership effect, as both product ownership and group membership are known to be part of self-construction (Abrams and Hogg 2001; Tropp and Wright 2001). When a product is owned by an in-group member, it is akin to the product being owned by the self, but when a product is owned by an out-group member, the instrumental value of the product imbuing a dominance trait to the self is significantly reduced. Thus, we predict that high *f*WHR of an in-group-owned product will lead to a positive evaluation, but high *f*WHR of an out-group-owned product will not show a similarly positive evaluation.

Method

Participants, Design, and Stimuli. Two hundred ten participants (82 female; 156 Caucasian; age range 19 to 64) from an online panel took part in this study for payment and were randomly assigned to one of four conditions in a 2 (group membership: in-group vs. out-group) × 2 (*f*WHR: high vs. low) between-subjects design. We manipulated group membership using scenario descriptions such that the human faces were presented as belonging to a potential player for one's own versus an opponent's football team, while the car faces were presented as belonging to a car owned by a neighbor who was very nice versus very obnoxious (see the web appendix for detailed descriptions). All participants were randomly presented with four sets of human and product faces with one of two ratios. A new set of four automobile images (different from those used in study 1) was selected for greater generalizability; the human faces remained the same.

Dependent Measures. All participants were asked to rate the perceived dominance and preference for the presented face stimuli (separately for the human and product faces), measured using the same items as in study 1.

Results and Discussion

Manipulation Check. To test the effectiveness of the group-membership manipulation, in two separate pretests participants indicated their perceived closeness with the presented human faces ($n = 91$) and product faces ($n = 94$) using three-item measures (close, relevant, on your side; seven-point rating scale). As expected, participants rated the faces depicted as belonging to the in-group member to be significantly greater in perceived closeness compared to those depicted as belonging to an out-group member, for both the humans ($M_{\text{ingroup}} = 4.45$, $M_{\text{outgroup}} = 3.07$, $t(89) = 4.98$, $p < .001$) and the cars ($M_{\text{ingroup}} = 2.81$, $M_{\text{outgroup}} = 2.00$, $t(92) = 2.55$, $p < .02$).

Dependent Variable: Dominance. As expected, a 2 × 2 ANOVA on a dominance index we created by averaging the three associated items (human faces: $\alpha = .85$; automobile faces: $\alpha = .69$) revealed no interaction effect. However, there was an expected significant main effect of ratio. Regardless of group membership, high-ratio human faces were perceived as more dominant ($M = 5.08$) compared to low-ratio human faces ($M = 4.15$, $F(1, 206) = 100.9$, $p < .001$, $d = 1.39$). Contrast analysis revealed that low-ratio human faces were rated as being less dominant compared to high-ratio human faces for in-groups ($M_{\text{low}} = 4.13$, $M_{\text{high}} = 5.13$; $F(1, 206) = 64.39$, $p < .001$, $d = 1.52$) as well as for out-groups ($M_{\text{low}} = 4.17$, $M_{\text{high}} = 5.03$, $F(1, 206) = 39.3$, $p < .001$, $d = 1.29$). In the same vein, we found an expected significant main effect of ratio on perceived dominance of product faces, but no significant interaction effect of group membership and ratio ($F < 1$). Specifically, the product faces with low ratio were rated as being less dominant ($M = 3.77$) compared to the high-ratio product faces ($M = 4.18$, $F(1, 206) = 9.2$, $p < .005$, $d = .42$). As before, contrast analysis revealed that the low-ratio product faces were rated as being less dominant compared to the high-ratio faces both for the in-group ($M_{\text{low}} = 3.73$, $M_{\text{high}} = 4.19$, $F(1, 206) = 6.67$, $p < .01$, $d = .49$) as well as for the out-group ($M_{\text{low}} = 3.82$ $M_{\text{high}} = 4.16$, $F(1, 206) = 3.02$, $p = .08$, $d = .35$).

Dependent Variable: Preferences. A 2 × 2 ANOVA was conducted on a person preference index we created by averaging the two associated items ($\alpha = .87$). Results revealed a marginally significant interaction effect between group membership and ratio ($F(1, 206) = 3.58$, $p = .06$) and significant main effects of group membership and ratio. As expected, human faces with a high ratio ($M = 3.87$) were liked less compared to low-ratio faces ($M = 4.20$; $F(1, 206) = 7.33$, $p < .01$, $d = .38$). In general, in-group human faces were preferred ($M = 4.24$) compared to out-group faces ($M = 3.82$; $F(1, 206) = 7.64$, $p < .01$, $d = .39$). A contrast analysis showed that the ratio effect was found only when the human faces were presented as out-group. That is, compared to the low-ratio out-group faces

($M = 4.14$), high-ratio out-group faces were liked less ($M = 3.57$, $F(1, 206) = 9.75$, $p < .005$, $d = .65$). However, as predicted, when the same faces were presented as those of an in-group member, the ratio effect was not observed ($M_{low} = 4.25$, $M_{high} = 4.14$; $F < 1$).

A 2 × 2 ANOVA on the car preference index ($\alpha = .81$) did not show a significant interaction effect, but there were significant main effects of face ratio and group membership. As found in study 1, product faces with a high ratio ($M = 4.15$) were liked more compared to those with low ratio ($M = 3.74$; $F(1, 206) = 6.1$, $p < .05$, $d = .34$). In general, in-group product faces were preferred ($M = 4.11$) compared to out-group ($M = 3.75$; $F(1, 206) = 5.05$, $p < .05$, $d = .31$). Notably, the high-ratio product faces associated with the in-group were evaluated more positively ($M = 4.37$) compared to low-ratio product faces with in-group ownership ($M = 3.83$; $F(1, 206) = 6.38$, $p < .01$, $d = .48$); however, when the same product faces were presented as belonging to cars owned by an out-group person, the effect of ratio was no longer significant ($M_{low} = 3.64$, $M_{high} = 3.87$; NS).

Moderated Mediation Analyses. To better evaluate the underlying mechanism of the observed effect, we examined the indirect effect following the procedure outlined by Hayes (2012, model 7). The analyses using 5,000 bootstrap samples revealed that the mediating effect is conditionally dependent on group membership. That is, the effect of the ratio on preference is mediated through dominance only when the product face is presented as in-group (95% CI: .06 and .55) but not when those products are owned by out-group members (95% CI: –.03 and .46).

Study 2 showed that the different evaluations for high- versus low-ratio human and product faces are dependent on whether or not the face is seen as belonging to someone who is considered to be a part of the self. These results thus provide further support for the premise that the positive effect of product face ratio on product liking is due to the ability of such a product to instrumentally endow the owner with a greater level of dominance, as theorized. It is interesting to note that while the participants perceived the high-ratio faces (both cars and people) as being more dominant across all conditions, the consequent effect of perceived dominance on preference for the face depended on whether the face belonged to an in-group or an out-group member. In particular, while the high-ratio human face was seen as being more dominant, this face was assessed as less likeable only when it belonged to an out-group member. When the same dominant face was associated with an in-group member, participants were able to overcome their "dislike" for it—potentially because such an in-group member was likely someone they liked to begin with and hence they did not perceive this face as being threatening. In the same vein, for a high-ratio product face, the more positive evaluation of an in-group-member-owned product was attenuated when the instrumental value of this empowerment was unavailable due to the product belonging to an out-group member. Thus, even though the participants accurately perceive greater dominance in a high-ratio product face, their evaluation of this face depended on the in-group versus out-group association. These results suggest that if perceived dominance of the product or human face is not consequential, the overall evaluation of the face would not necessarily differ by *f*WHR.

These results lead us to an important next question. Would the type of goal affect the perceived dominance and overall evaluation of a product as noted in study 2, or would the pattern differ such that both perceived dominance and overall evaluation are dependent on the type of goal?

STUDY 3: COMPATIBILITY OF GOAL WITH DOMINANCE CUES

Prior work that examined the effect of goal salience on face perception (Maner et al. 2005) found that when people were primed with a goal (e.g., mate selection), they were more likely to "see" goal-compatible traits in the faces (e.g., seeing faces as more sexy). In keeping with this, we hypothesized that participants would more readily associate high *f*WHR product faces with dominance when a dominance goal is activated (a compatible goal) than when an affiliation goal is activated (an incompatible goal). An affiliation goal is proposed here as being opposite to a dominance goal since dominance and aggression tend to destabilize and undermine valuable relationships and affiliations (Kirkpatrick et al. 2002).

Method

Participants and Design. One hundred eighty-two participants (72 female; 119 Caucasian, age range 18 to 67) from an online panel took part in this study for payment and were randomly assigned to one of four conditions in a 2 (goal: dominance vs. affiliation) × 2 (ratio: high vs. low) between-subjects design. Participants were presented with four different car faces, each with the same ratio. For this and all subsequent studies, we focused only on product faces and did not employ human faces in our stimuli material.

Goal Manipulation. We manipulated the goal using scenario descriptions. Participants in the dominance-goal condition were instructed to imagine that they were considering renting a car for an important business meeting with a competitor, whereas those in the affiliation-goal condition were instructed to imagine renting a car for a very special social date (see the web appendix). To reinforce the goal manipulation, all participants were instructed to write down the reason they were seeking a rental car. They were

further told that the rental company provided images of the available cars, which were then shown to them.

Dependent Measures. We measured perceived dominance using three items as before. As the main dependent variable, the amount that participants were willing to pay ($) for renting the car was measured. Not all participants answered every item; degrees of freedom, therefore, vary across different measures.

Results and Discussion

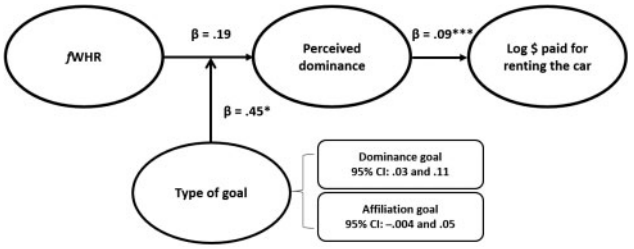
Manipulation Checks. A separate study ($n = 79$) was conducted to test the effectiveness of the goal manipulations. Participants were asked to read the scenario and then indicate the factors they considered important for the upcoming meeting. We measured dominance motivation using three items (e.g., feeling empowered); we measured affiliation motivation using three other items (e.g., feeling warm toward the person). All items were assessed on a seven-point scale (1 = not at all important, 7 = very important). As expected, participants in the dominance-goal (business trip) condition reported higher ratings on the need for dominance compared to the affiliation-goal (dating) condition ($M_{dom} = 4.52$, $M_{aff} = 3.27$, $t(77) = 4.56$, $p < .001$) and lower on the need for affiliation ($M_{dom} = 5.32$, $M_{aff} = 6.42$; $t(77) = -4.53$, $p < .001$).

Dependent Variable: Perceived Dominance. A 2 × 2 ANOVA on the perceived dominance for the four automobile stimuli ($\alpha = .76$), revealed a main effect of ratio ($F(1, 165) = 20.29$, $p < .001$, $d = .70$) whereby higher ratio increased dominance perception. Further, there was an expected significant interaction effect ($F(1, 165) = 5.81$, $p < .05$) such that participants in the dominance-goal condition perceived the high-ratio car face as more dominant ($M = 4.87$) compared to the low-ratio car face ($M = 4.23$; $F(1, 165) = 23.5$, $p < .001$, $d = 1.08$). As expected, in the affiliation-goal condition, the perception of dominance across the two ratio conditions, though directionally similar, was not significantly different ($M_{high} = 4.64$, $M_{low} = 4.45$, NS).

Dependent Variable: Willingness to Pay (WTP). As a next step, we analyzed the amount participants reported they were willing to pay for renting the car using a 2 (ratio) × 2 (goal type) ANOVA. Since the reported dollar amounts were not normally distributed, the values were log-transformed. The main effect of ratio was marginally significant, whereby participants were willing to pay a higher amount for automobile faces with a high ratio ($M = 1.60$) compared to low ratio ($M = 1.54$; $F(1, 178) = 2.95$, $p = .08$, $d = .26$). No significant effect of type of goal was found ($M_{dom} = 1.59$, $M_{aff} = 1.54$; NS). Further analysis yielded a marginally significant interaction between ratio and type of goal ($F(1, 178) = 3.48$, $p = .06$), with pairwise comparison revealing that, under the dominance goal, participants were willing to pay a higher amount for high-ratio car faces ($M = 1.67$) than low-ratio faces ($M = 1.54$; $F(1, 178) = 6.34$, $p < .05$, $d = .56$). However, as expected, this effect disappeared when participants were primed with an affiliation goal such that there was no difference in their WTP for the high-ratio car face ($M = 1.54$) or the low-ratio car face ($M = 1.55$; $F < 1$).

FIGURE 2

MODERATED MEDIATION ANALYSIS (STUDY 3)



NOTES.—* $p < .05$, ** $p < .01$, *** $p < .001$.

Moderated Mediation Analysis. An analysis using 5,000 bootstrap samples (Hayes 2012, model 7; see figure 2) revealed that the interaction between ratio and type of goal predicted perceived dominance ($\beta = .45$, $p < .05$), and perceived dominance significantly influenced WTP ($\beta = .09$, $p < .001$). However, when perceived dominance was entered into the regression, the effect of ratio on WTP dropped ($\beta = .006$, NS). Furthermore, the significant indirect effect of ratio on WTP was conditional on the dominance goal (95% CI: .03 and .11) but not on the affiliation goal (95% CI: –.004 and .05).

The results of study 3 suggest that compatibility between goals and perceptual signals from face ratio affects the sensitivity of individuals to facial dominance cues, which in turn influences the effect of ratio on preferences. An incompatible goal not only inhibits positive evaluation of the target but also impairs perception of dominance. Thus, this study shows the noteworthy context (affiliation goal) when consumers are unable to "read" the dominance signal from the high *f* WHR of the product face, highlighting the strong effect of motivational drive. Interestingly, in this study we observed significant effects (in the dominance-goal condition) even when the car was simply being rented temporarily by the consumer, pointing to the strength of the phenomenon.

One potential criticism of the previous studies could be that the manipulation of high versus low ratio of the car faces might also have resulted in some differences in the perceived size of the car. Prior research showed that size is often seen to signal power (Dubois et al. 2012). Consequently, if high face ratio also results in the product

being perceived as larger, the effect of dominance might really have been due to perceived differences in size. To rule out this possibility, we conducted a post-test to see if the stimuli for high- and low-ratio conditions are perceived differently in terms of size, sturdiness, and durability (n = 102). Participants were randomly assigned to either a high- or low-ratio condition. Each participant rated the same four car faces used in studies 2 and 3, each of the same ratio, on size, sturdiness, and durability using a seven-point scale. Results showed no differences between high-ratio and low-ratio cars on size (M_{high} =4.40, M_{low} = 4.22, $t(100)$ = 1.44, NS), sturdiness (M_{high} = 5.08, M_{low} = 4.91, $t(100)$ = 1.14, NS), and durability (M_{high} = 5.02, M_{low} = 4.91, $t(100) < 1$, NS). Although the results of this post-test are encouraging, in order to fully rule out the size-based alternative explanation, it was deemed important to use a product face manipulation that was not open to such an alternative interpretation. Thus, we used a different product—a clock—in the next study to ensure that the product's overall size was identical across different face-ratio conditions.

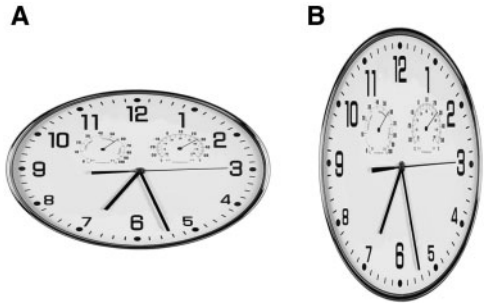
Since we explicitly manipulated goals in study 3, one additional objective of the next study was to use a subtler goal manipulation. Chartrand and Bargh (1996) posit that situational cues can also activate goals that operate similarly to deliberative goals. Further, social interaction plays a key role in the process of symbolic self-completion (Mahler 1933). Consequently, it is highly likely that, relative to private consumption, public consumption better activates a self-completion goal and makes the goal of signaling dominance seem more desirable. Thus, we suggest that the dominance-signaling ability of a product with high face ratio would have a significantly stronger effect in a public consumption context.

STUDY 4: THE ROLE OF A PRIVATE VERSUS PUBLIC USAGE CONTEXT

As noted, the goal of study 4 was twofold. First, we aimed to replicate the findings of study 3 with a subtler manipulation of goals: we expected that merely changing the context from private to public usage of the product would make the dominance goal more salient. Second, to generalize our proposed effect and to rule out the alternative explanation based on perceived product size, we chose a product that would be associated with a humanlike face while ensuring that a change in *f*WHR did not change the size perception. An analog clock showing the time of 10:10 mimics a smile and thereby activates the human face schema (Guthrie 1993). Thus, in study 4, we presented an analog clock for use in either a private home office or at one's formal workplace, which is much more public. Further, the clock visuals were manipulated such that in both the high- and low-ratio conditions the dimensions, total area, and hence overall size of the product were identical (see figure 3). Our key prediction was that a high *f*WHR would influence perception of dominance and preference for the product in the public office condition significantly more than in the private office condition.

FIGURE 3

STIMULI EXAMPLES (STUDY 4)



Measuring points used for morphometric calculations and examples of high and low face ratio. Panel (A): Example of high-ratio clock face (33% greater *f*WHR = 1.67). Panel (B): Example of low-ratio clock face (33% lesser *f*WHR = .59). The clock face images are representations of the experimental stimuli for illustrative purposes only (image source: shutterstock.com). The actual stimuli used for the experiments are available from the authors.

Method

Participants, Design, and Stimuli. One hundred eighty-three college students (62 female; 158 Caucasian, age range 18 to 26) participated in this study for extra credit and were randomly assigned to one of the four conditions: 2 (*f*WHR: high vs. low) × 2 (usage context: private vs. public). Images of two clocks with *f*WHR manipulation (see figure 3) were presented either for a private home office or for a public office at one's workplace (see the web appendix for detailed scenario descriptions). Participants were then administered the dependent measures.

Dependent Measures. After being exposed to the stimuli, participants indicated the degree of perceived dominance of the product face, as well as their preference for the clock (the main dependent variable), both of which we measured using the same three items from studies 1–3.

Results and Discussion

Manipulation Checks. To assess the effectiveness of the usage-context manipulation, we conducted a separate pretest (n = 101). Participants were asked to indicate the role of the clock (in the public vs. private contexts) in self-presentation (e.g., "represent my self-image," "communicate who I am," 1 = not at all agree, 7 = totally agree). As expected, participants in the public condition

were more likely to report that the clock would show who they are ($M = 4.73$) relative to those in the private condition ($M = 3.82$, $t(99) = 2.65$, $p < .01$).

Dependent Variable: Perceived Dominance. Although a 2 × 2 ANOVA on the composite three-item dominance score ($\alpha = .67$) revealed no significant main effects or interaction effect between ratio and product type on perceived dominance, a pairwise comparison was deemed appropriate due to our specific ex ante hypothesis about the public usage context. Our analysis revealed a simple effect of product ratio only in the public-context condition. Consistent with the previous studies, participants in the public condition perceived the high-ratio clock face as being more dominant ($M = 4.18$) compared to the one with a low ratio ($M = 3.89$, $F(1, 179) = 3.76$, $p = .05$, $d = .40$). However, when the clock was presented for private use, no significant difference was found between the high- and low-ratio images ($M_{high} = 3.91$, $M_{low} = 3.90$; $F < 1$).

Dependent Variable: Preferences. A 2 × 2 ANOVA on the composite three-item liking score ($\alpha = .76$) revealed no significant main effects or interaction effect between ratio and product type on preferences. However, as before, a pairwise comparison revealed significant differences such that when presented for a public office, the high-ratio clock ($M = 3.66$) was preferred more than the low-ratio clock ($M = 3.23$, $F(1, 179) = 4.25$, $p < .05$, $d = .48$), but not when the same clock was presented for a private office ($M_{high} = 3.26$, $M_{low} = 3.31$; $F < 1$).

Moderated Mediation Effect. To assess the hypothesized role of perceived dominance on product evaluation, we conducted moderated mediation analyses (Hayes 2012, model 7). Supporting our theory, an analysis using 5,000 bootstrap samples revealed that perceived dominance mediated the impact of product face ratio on preferences only when the clock was presented for a public office (95% CI: .02 and .34) but not when the clock was presented for use in a private office (95% CI: –.15 and .18).

In summary, these findings replicate the results of study 3 showing that the effect of face ratio on perceived dominance and evaluations is more evident when the dominance goal is salient because they can be used as a signaling device for power, as would be the case when the product is used publicly. This effect goes away when the product has no instrumental value for self-empowerment, as would be the case in the context of private consumption. One advantage of study 4 is that we manipulated the dominance goal quite subtly by using the context of public consumption, thereby underscoring the strength of the effect. Importantly, this study also rules out the size-based alternative explanation.

Although study 4 provides additional evidence of the link between dominance goal and preference for high-ratio product faces, one possible concern could be that a public consumption context is not associated with a dominance goal alone. Previous research has shown that public display can be associated with a preference for status-signaling products (Dubois et al. 2012). Thus, it is not clear if the effects of study 4 were driven by perceived dominance or by perceived status (hereafter prestige). While the notion of prestige is somewhat similar to dominance, the two concepts are not identical, as discussed earlier. Our predicted effect of *f*WHR is based exclusively on the idea of dominance or power but not on wealth or prestige. In study 5, we attempt to tease apart the effect of dominance and prestige.

STUDY 5: THE DISTINCT ROLES OF DOMINANCE AND PRESTIGE

Prior research has shown that wealth functions as a marker of both prestige and dominance by signaling the owner's accumulated success and by creating asymmetric control over rewards and punishment (Mills 1956). Thus wealth, in essence, can be an outcome as well as a proxy cue of both dominance and prestige (Cheng and Tracy 2013). Therefore we controlled for the wealth signal by presenting the stimuli as cheap, ordinary products. Next, we manipulated two goals—dominance versus prestige—to contrast the effect of face ratio under these two different goals. Given no wealth effect, we predicted that the effect of face ratio would persist under the dominance- but not under the prestige-goal condition. Finally, another objective of study 5 was to replicate the effect observed in study 4 that ruled out perceived size of the product as an alternative explanation. Thus, we used a wristwatch (a variant of the clock used in study 4) as the product category.

Method

Participants, Design, and Stimuli. One hundred sixty-seven participants (59 female; 108 Caucasian, age range 18 to 65) from an online panel participated in this study for payment and were randomly assigned to one of the four conditions. The study was a 2 (goal type: dominance vs. prestige) × 2 (*f*WHR: high vs. low) between-subjects design where the product was presented as a cheap, ordinary item across all conditions. Scenarios about a high school reunion were employed to manipulate the two goals: need for dominance or need for prestige (see the web appendix). Participants in the dominance-goal condition were instructed to imagine that they were preparing for their 10-year high school reunion, where they were likely to see the high school bully, whereas those in the prestige-goal condition were told that they were likely to see someone they wanted to impress—a person they admired during their school years who had now become a very successful lawyer. Participants were further told that they were going shopping to prepare for this event. Images of four different

watches were manipulated on the width-to-height ratio (see the web appendix). Since the actual ratios for the four watches varied slightly, we used a ratio of 23% higher and lower than the actual product (e.g., high ratio: 1.3 vs. low ratio: .76). An image of each of the four watches was presented with a short description of it as a commonly available, low-priced, ordinary brand sold for $55.

Dependent Measures. After being exposed to the stimuli, participants indicated the degree of perceived dominance of the product faces, which we measured using two items (powerful, aggressive). Participants then reported their preference including liking and positive evaluation (1 = not at all, 7 = extremely).

Results and Discussion

Manipulation Checks. To test the extent to which the two high school reunion scenarios primed different goals, we conducted a separate pretest as a manipulation check ($n = 66$). As expected, participants in the dominance-goal condition demonstrated greater need for dominance ($M_{dom} = 3.55$, $M_{pre} = 2.73$, $t(60) = 2.32$, $p < .05$) and lower need for prestige ($M_{dom} = 5.22$, $M_{pre} = 5.79 t(62) = -2.06$, $p < .05$) than those in the prestige-goal condition.

Dependent Variable: Perceived Dominance. A 2 × 2 ANOVA on the composite two-item dominance score ($\alpha = .87$) revealed a significant main effect of ratio ($F(1, 163) = 7.38$, $p < .01$, $d = .42$) and a significant interaction between goal and ratio ($F(1, 163) = 7.03$, $p < .01$). Consistent with the previous studies, participants perceived the high-ratio watch face as being more dominant ($M = 3.91$) compared to the one with a low ratio ($M = 3.39$). Further, these effects were qualified by an interaction effect: under the dominance goal, participants perceived the high-ratio watch face as being more dominant ($M = 4.1$) than the low-ratio watch face ($M = 3.13$, $F(1, 163) = 15.26$, $p < .001$, $d = .82$). Under the prestige goal, there was no effect of ratio on the participants' sensitivity to perceived dominance ($M_{low} = 3.66$, $M_{high} = 3.67$; $F < 1$).

Dependent Variable: Preferences. As a next step, we analyzed how the assessment of the high- versus low-ratio product translated into preferences. Although no significant main effect was found, a 2 × 2 ANOVA on the composite two-item liking score ($\alpha = .88$) revealed a significant interaction between goal and ratio ($F(1, 163) = 6.11$, $p < .05$). As expected, under the dominance goal, the high-ratio watch face was liked more ($M = 4.17$) than the low-ratio watch face ($M = 3.53$, $F(1, 163) = 7.57$, $p < .01$, $d = .58$). When the prestige goal was activated, however, the high-ratio watch face was not rated more positively ($M = 3.88$) compared to the low-ratio watch face ($M = 4.07$; $F < 1$). This null effect of high ratio on preferences under the prestige goal is consistent with past research suggesting that dominance cues can hinder achieving prestige (Cheng and Tracy 2013).

Moderated Mediation Analysis. A moderated mediation analysis using 5,000 bootstrapping samples (Hayes 2012, model 7) revealed a significant interaction between goal and ratio on perceived dominance ($\beta = -.96$, $p < .01$) and a positive influence of perceived dominance on the preference for the watch ($\beta = .73$, $p < .001$). However, when the perceived dominance rating was entered into the regression model, the interaction effect between ratio and goal type became nonsignificant ($p > .1$). As predicted, perceived dominance only mediated the effect of ratio on preference under the dominance goal (95% CI: .38 and 1.07), but the face ratio no longer influenced preference under the prestige goal (95% CI: –.37 and .44).

Study 5 successfully teases apart the effect of dominance from prestige, showing that a dominance goal facilitates perception of dominance cues from a high-ratio product even when the wealth signal is eliminated. This heightened dominance perception from a high-ratio watch face leads to a greater preference for the product in the dominance-goal condition compared to the condition of a prestige goal, which suppresses the perceptual sensitivity to dominance cues from face ratios. Since watches for females are usually narrow-faced, whereas those for males are normally wider-faced, we tested for any gender differences. A 2 (ratio) × 2 (gender) ANOVA on preference index did not show significant interaction or simple effects (both $F < 1$).

Furthermore, a 2 (ratio) × 2 (goals) × 2 (gender) ANOVA on preference index revealed marginally significant interaction ($p = .1$) with both males and females showing significant preferences for the high-ratio watch under the active dominance goal (both $p < .05$) but no differences under the prestige goal. These results provide evidence that the salient goal allows the evaluations based on face ratio to be influenced through modulating visual perception of the faces. While the results of study 5 confirm the influence of ratio on preferences and provide additional evidence supporting the broader generalizability of the effect beyond cars, the data also suggest that this effect may be attenuated when the goal of prestige is salient for an ordinary (low-priced) product. Simultaneously, our data suggest that the effect of a dominance cue from a high-ratio face on preferences might be independent of the wealth signal (price).

GENERAL DISCUSSION

Across five studies, our research demonstrates that consumers associate product face ratio (*f*WHR) with dominance traits, and that this perceived dominance influences product evaluations. Further, product faces are perceived in much the same way as human faces, such that a higher face ratio is associated with greater perceived dominance.

One key contribution of our research is to highlight a crucial difference in the downstream effect of high perceived dominance on overall evaluations of product faces and human faces. While prior research finds that high-ratio human faces that signal dominance are liked less, we find that products with high face ratio also signal high dominance but are liked more, not less. Further, we identify a number of moderators of this effect (e.g., in-group vs. outgroup, study 2; dominance goal vs. affiliation goal, study 3; public vs. private consumption context, study 4; dominance vs. prestige goal, study 5) while also using diverse product categories (automobiles, studies 1–3; clocks, study 4; watches, study 5). Importantly, we identify the context when face ratio affects perception of dominance but not evaluations (study 2) as well as the context when face ratio does not affect the perception of dominance or evaluations (studies 3–5), and highlight the crucial role of goal salience in people's (in)ability to "read" dominance signals from high-ratio product faces.

Since we ran five different studies that varied on many aspects (participant pool, goal salience, product type, dependent measure, etc.), we deemed it important to conduct a meta-analysis comparing the results of all studies directly, in order to get a better sense of the consistency of the effect (Cumming 2013).[1] To this end, we conducted a meta-analysis following Schmidt and Hunter's (2015) random effects model. Unlike a fixed-effects model, which assumes that the studies reviewed follow an identical population parameter, random-effects meta-analyses allow the effect sizes in the studies to follow distinct distribution of population parameters (Farley and Lehmann 1986; Schmidt and Hunter 2015). Overall, we found that high-ratio product faces are associated with greater dominance and liked more with a mean difference of $d = .6$ for perceived dominance and $d = .44$ for preferences. Naturally, given the aforementioned varying design elements of the different studies, there was some heterogeneity in the effect sizes across the studies; however, it was modest (SD = .13), and this minimal variability rendered the effect sized significantly greater than $\mu_D = 0$ (for $d = .60$, $z = 9.23$; for $d = .44$, $z = 6.77$). The standard deviation implies some variability across studies, but once adjusted for sample sizes, it was not significantly different from a population value of zero ($\sigma_D = 0$; $z = .01$).

Theoretical Implications

The current research contributes to the anthropomorphism literature by showing the ways in which anthropomorphic products are used as a source of signaling empowerment. Although researchers have previously shown some key differences in perceiving products as humans compared to perceiving products as objects (Aggarwal and McGill 2007; Ahn, Kim, and Aggarwal 2014; Kim and McGill 2011; Landwehr, McGill, and Hermann 2011), our research is different in that it highlights the similarities and differences in how people perceive products (that are endowed with a humanlike feature such as having a face) compared to how they perceive humans themselves, demonstrating that dominance cues from static facial structure of humans and products are perceived in a similar way. Importantly, we also highlight key differences in preference for these faces, showing that people generally dislike dominant-looking human faces but like dominant-looking product faces—thereby underscoring the nuanced differences in how we perceive people and anthropomorphized products. Prior research by Landwehr et al. (2011) showed that automobile faces are processed similar to human faces, with consumers showing greater preference for aggressive, dominant-looking headlights (eyes) because those facial expressions generate more arousal. Our research offers the opportunity to advance theoretical models of processing of anthropomorphized product faces by integrating this prior research on the same stimulus category and showing that static facial cues (based on face morphology—i.e., face ratios) alone can suffice for making predictions about product evaluation, and that more complex stimuli like facial expressions may not be essential.

This research also contributes to the body of literature on conspicuous consumption and luxury goods marketing. Most extant research suggests that people purchase expensive luxury products in order to display their status. The stream of research has often manipulated status-signaling products in terms of types of products and measured the amount of money spent on each (Rucker and Galinsky 2008). To our knowledge, very little effort has been expended to test within-category effects that might be relevant for signaling high status (see O'Guinn, Tanner, and Maeng 2015 for an exception). Furthermore, while previous research mostly focuses on the wealth and prestige aspect of social status, not much attention has been paid to other types of status cues such as dominance and empowerment. Here, we demonstrate adaptive consumer response to dominant-looking products that are seen as able to enhance one's own dominance status. The ecological theory of social perception proposes that innate or well-developed attunements to stimulus information can result in overgeneralized perceptions (Zebrowitz et al. 2003). However, our data suggest that this overgeneralized perception of facial cues is likely to be motivationally charged and contextually dependent. In particular, we found that this dominance inference from high-ratio faces is consequential (i.e., results in greater preferences and WTP) when consumers are especially motivated to dominate or control others in a competitive setting.

The current research further contributes to research on dominance. There is a dearth of research in marketing

1 We thank an anonymous reviewer for this suggestion.

examining the role of perceived dominance on consumer evaluations. As one of the few exceptions, Dubois et al. (2012) showed that the physical size of food and drinks signals status; thus, when people feel they lack power, they choose larger-sized foods and drinks to try to regain a sense of power. Our research significantly contributes to the literature on the role of dominance in consumer behavior by offering an insight. We propose one specific trait—*f*WHR of a product face—as a simple cue that influences a product's perceived dominance and the consumer's overall preference.

Practical Implications

Our findings have real market implications, providing a rationale for why automobile manufacturers, for example, may want to charge more for models with wider faces. In fact, to assess if such an effect might actually be observed in real life, we conducted an empirical test using real market data, looking for a relationship between price and *f*WHR for cars sold in the marketplace. For all 533 different models sold by the 25 manufacturers doing business in the United States, data were obtained in November 2013 on a number of dimensions, including price, product specifications (i.e., width and height) to generate *f*WHR information, and body type (sedan and convertible). Simple regression coefficients estimation revealed that *f*WHR significantly predicts automobile price ($\beta = 243.03$, $p < .001$). In particular, the ratio was a significant predictor of prices for convertibles ($\beta = 297.41$, $p < .001$) as well as for sedans ($\beta = 71.95$, $p < .01$). In other words, market data suggest that the significant positive effect of *f*WHR on car prices held for the different product classes, and that manufacturers are able to charge more for cars with wider faces regardless of brand, model, or body type. Although this result is strictly correlational, we do consider it an important piece of evidence from the field that provides vital confirmatory support in favor of our premise related to the downstream effects of product face ratios.

Future Research

Our research showed that inferences of underlying traits, in particular dominance, arise from a product's *f*WHR—a novel and hitherto unexplored response to anthropomorphic products. For a more comprehensive understanding of consumer responses to anthropomorphic products, we need greater knowledge of other aspects of the products' looks (e.g., body, posture, shape, color), which will help us understand human–product interaction at a deeper level. We believe that a better understanding of people's mental representation of a product's looks will aid in the development of more effective product designs. Indeed, literature on robotics suggests that a more humanlike appearance is a better match for jobs that are social in nature, such as a dance instructor, and a more machinelike robot is more appropriate for less social jobs, such as a security guard (Goetz, Kiesler, and Powers 2003). Future research could investigate how this perceptual inclination and consequent trait inference influences the way consumers interact with products. For example, marketers might investigate which categories better fit high-ratio (dominant-looking) products and low-ratio products. Future research could examine if products such as navigator or training devices that consumers see in a boss/adviser role may be seen as more competent if endowed with high-ratio faces, whereas products such as a cleaning robot that consumers want more control over (i.e., servant role; Aggarwal and McGill 2012) may be seen as more trustworthy if endowed with low-ratio faces. Such work could also assess the impact of different face ratios separately on product aesthetics as well as product ergonomics.

One particularly interesting and timely possible extension of our findings might be to examine the implications for manufacturers of self-driving automobiles. Google and Uber, the two front-runners in this category, are in the final stages of testing self-driving vehicles. In fact, Uber plans to start its self-driving taxi services soon (Levin and Harris 2017). Furthermore, some US states have already developed necessary laws for self-driving vehicles (McFarland 2017). A theoretically interesting and practically important question might be whether *f*WHR of self-driving cars influences preferences for a self-driving automobile in a different way from that of traditional automobiles. The big difference between traditional and self-driving automobiles is the locus of control. For traditional cars, the consumer (i.e., the driver) has control, whereas in autonomous vehicles the consumer does not have much control. Thus, it is possible that self-driving automobiles are not perceived as part of the self as much as traditional automobiles are. If that were so, then how might this difference in perceived locus of control influence consumers' preferences for the automobile, and in particular the face ratio?

Previous research suggests a cultural variation in face perception. For example, Miyamoto, Yoshikawa, and Kitayama (2011) demonstrated that, when asked to identify a prototypical face, Asians allocate more attention to configuration information than Westerners. Further, Asians were found to be more accurate than Westerners in identifying the spatial configuration of features. In fact, there is evidence that cultural differences can be observed not only in perceptual processing but also for perceived suitability of faces for leadership roles. Rule and colleagues (2010) found that perceived power but not perceived warmth predicted winners in US elections, whereas perceived warmth but not perceived power predicted winners in Japanese elections. If these intriguing cultural differences are observed for human face perception, it might be a lucrative path for future research to investigate patterns in cultural variation for responses to anthropomorphic product designs.

Interestingly, prior research has shown that despite having a high ratio, a face might be perceived to have childlike traits when it has large eyes, a large and prominent forehead, a small chin, and a round shape (Gorn, Jiang, and Johar 2008). Such a "baby face" even with high *f*WHR might be perceived as being the opposite of dominant—being socially dependent, intellectually naïve, and physically weak but warm (Berry and McArthur 1985; Keating 1985). It would be interesting for future research to examine contexts in which people pay more or less relative attention to face ratio versus baby features, and how they reconcile these two trait types that signal opposing characteristics.

Finally, a gender difference has been reported in the realm of conspicuous consumption (Wang and Griskevicius 2014): women seek and display lavish luxury products to deter female rivals when the motive to guard their mate is activated. We believe our data are consistent with these findings. Our research demonstrates that motivation to dominate and control others enhances the perception of dominance signals from face ratio, and the context of women's motivation to guard their mate might be such a situation. In our research, we did not specifically explore gender differences in responses to product face ratios, and arguably, one potential limitation of our research is that our first two studies employed only male faces. Given that in most societies women and men differ in their actual and perceived dominance status as well as in their role expectations, we think that extending our research to explore gender differences might be a fruitful endeavor. Going back to our opening example, we may find that how people respond to a car with an "angry face" or a "smiling face" may depend not just on the car face but also on whether one is a male or female driver. In fact, our stereotypes about female drivers or any other group might really be better explained by the purported dominance or lack of it within these groups in the society.

DATA COLLECTION INFORMATION

We have no interests that might be interpreted as influencing the research, and we followed appropriate ethical standards at all times. The first and second authors jointly designed all the studies and managed data collections using online panels. Study 1 was conducted in spring 2014, study 2 in spring 2015, study 3 in spring 2015, and study 5 in spring 2016. Study 4 was conducted in fall 2016 using students at the University of Kansas. These data were analyzed by the first author in consultation with the second author.

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