Perception of Anthropomorphic Traits in Cars

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Contents

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Abstract

Humans have a natural tendency to attribute traits typically ascribed to humans, to non–living agents. This phenomenon is called anthropomorphism and it is considered to promote the survival of the species, by facilitating social interaction and speeding up the detection of threatening stimuli. Thus, humans tend to detect faces in a variety of stimuli, such as clouds, stones, and cars. In this study, participants (N = 21) were required to rate 20 car front photos in a number of scales that were related to human traits, namely biological features, interpersonal relationships, personality traits, basic, and secondary emotions. They also rated how each image made them feel, whether they liked it, and if they would consider suggesting to a friend to buy it. The car images were divided into two groups, which differed only in the grilles shape, so that results could be comparable. Multivariate analyses were conducted comparing the two groups, in order to assess whether participants tend to anthropomorphize cars, as well as if they evaluate them differently, according to the grilles shape. Only cars of group A yielded statistically significant results, which showed that said cars were seen in anthropomorphic terms, although the participants did not like them. The results concerning the purchase intent were not statistically significant.

Keywords: anthropomorphism, non–living agents, survival, biological features, interpersonal relationships, personality traits, basic emotions, secondary emotions

Περίληψη

Οι άνθρωποι εκδηλώνουν μια εγγενή τάση να αποδίδουν χαρακτηριστικά που τυπικά περιγράφουν ανθρώπους σε μη ζώντες παράγοντες. Το φαινόμενο αυτό ονομάζεται ανθρωπομορφισμός και θεωρείται πως έχει τη βάση του στην επιβίωση του είδους, καθώς διευκολύνει την κοινωνική αλληλεπίδραση και κάνει ταχύτερη την ανίχνευση πιθανών απειλητικών ερεθισμάτων. Έτσι, οι άνθρωποι τείνουν να ανιχνεύουν πρόσωπα σε μια ποικιλία ερεθισμάτων, όπως σύννεφα, πέτρες και αυτοκίνητα. Στην παρούσα έρευνα, ζητήθηκε από τους συμμετέχοντες (N = 21) να αξιολογήσουν 20 φωτογραφίες με προσόψεις αυτοκινήτων μέσω κλιμάκων που σχετίζονταν με ανθρώπινα χαρακτηριστικά, όπως βιολογικά χαρακτηριστικά, διαπροσωπικές σχέσεις, στοιχεία προσωπικότητας, βασικά και δευτερεύοντα συναισθήματα. Αξιολόγησαν επίσης το συναίσθημα που τους προκάλεσε η θέαση του εκάστοτε ερεθίσματος, αν αυτό τους άρεσε και αν θα το πρότειναν σε κάποιον φίλο τους. Οι φωτογραφίες των αυτοκινήτων ήταν χωρισμένες σε δύο ομάδες που διέφεραν μόνο ως προς το σχήμα της γρίλιας τους, έτσι ώστε να μπορούν να συγκριθούν μεταξύ τους. Για την ανάλυση των αποτελεσμάτων διεξήχθησαν πολυμεταβλητές αναλύσεις διακύμανσης ανάμεσα στις δύο ομάδες ερεθισμάτων, για να φανεί αν οι συμμετέχοντες αποδίδουν ανθρωπόμορφα στοιχεία στα αυτοκίνητα, καθώς και αν τα αξιολογούν διαφορετικά, ανάλογα με το σχήμα της γρίλιας τους. Από τις αναλύσεις φάνηκε ότι μόνο τα αυτοκίνητα της ομάδας Α εμφάνισαν στατιστικά σημαντικά αποτελέσματα, στα οποία επιβεβαιώθηκε η απόδοση ανθρωπόμορφων χαρακτηριστικών από τους συμμετέχοντες, παρόλο που αποκρίθηκαν αρνητικά στην αρέσκεια προς αυτά. Τα αποτελέσματα για την πρόθεση να προτείνουν το εκάστοτε αυτοκίνητο σε κάποιον δεν ήταν στατιστικά σημαντικά.

Λέξεις–κλειδιά: ανθρωπομορφισμός, μη ζώντες παράγοντες, επιβίωση, βιολογικά χαρακτηριστικά, διαπροσωπικές σχέσεις στοιχεία προσωπικότητας, βασικά συναισθήματα, δευτερεύοντα συναισθήματα

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Human beings tend to ascribe human features to animals, inanimate objects, or natural phenomena (Cullen et al., 2014); the weather is often described as being “angry”, days are characterized as “happy”, and we all have been in a situation where we got irritated by an object for not working properly, as if it were a person not doing the task they have been assigned to. This phenomenon is called anthropomorphism, and it is a natural human tendency (Guthrie, 1993). It is practically a generalization of features, typically attributed to human beings, to non–human agents (Windhager et al., 2008). The term anthropomorphism is sometimes confused with animism, the belief that everything in nature has a soul, even objects and natural phenomena (Bird–David, 1999). However, anthropomorphism, as a term, goes beyond this, and imbues non–human agents, not only with a soul, but also with humanlike traits, intentions, and emotions (Epley et al., 2007).

According to Guthrie (1993), anthropomorphism is a strategy that promotes the survival of humanity. This probably happens because under–detection of possible threatening stimuli– hereto other individuals or animals– is riskier than over–detection; if we do not detect a threat, we may be irreparably harmed, but if we detect threats, even though they do not exist, there is almost no cost at all (Bulbulia, 2004; Fox et al., 2000; Guthrie, 1993; Windhager et al., 2008). The cost discrepancy between under–detection and over–detection of possible threats might have rendered us cognitively biased, making us susceptible to detecting faces almost everywhere, such as in clouds, stones, and cars (Guthrie, 1993). This viewpoint is in line with Gibson’s ecological approach to perception (1966, 1979), which posits that living organisms and the physical world share an inextricable bond, with the former receiving messages from the latter, while adapting their actions accordingly (Gibson 1966, 1977; Zebrowitz, 2003). This process helps humans

adjust to their environment, increasing the possibility of survival. Nevertheless, according to the same theory, even though perception is largely accurate, misjudgments are not rare, the reason behind this being overgeneralization effects (Zebrowitz, 2003). It should be noted though that the phenomenon of anthropomorphism exhibits great variability among individuals, and it is culturally dependent, as some cultures are more susceptible to manifesting it than others (Cullen et al., 2014).

As mentioned, anthropomorphism is a phenomenon that renders individuals prone to detecting human faces– among others –in non–living agents. Human faces convey a plethora of information, such as gender, age, psychological and emotional condition, character features and motives (Fox et al., 2000; Windhager et al., 2008), which constitute significant clues for social interaction, and facilitate decision–making (Willis & Todorov, 2006; Windhager et al., 2008; Windhager et al., 2012). More specifically, regarding biological features, we tend to rely on face proportions, to form a first impression about someone's age and gender (Lorenz, 1943; Fink et al., 2005).

Concerning age, babies and, in general, young children have bigger eyes and foreheads when compared to adults (Lorenz, 1943). Baby features are considered cute, eliciting positive and protective behaviors from adults that ensure the babies' survival (Kringelbach et al., 2016; Miesler et al., 2011). It appears that, not only babies, but also adults with childlike characteristics are considered warmer, more innocent, and more submissive (Berry & McArthur, 1986; Keating et al., 2003), in contrast to people that have more masculine and more mature facial features (Berry & McArthur, 1986). Moreover, babyish characteristics seem to attract attention almost instantly. Brosch et al. (2007) showed that individuals can detect infant faces –compared to adult faces– in no longer than one second. This instant capture of attention, indicated by the

aforementioned finding, has an evolutionary meaning too. For humanity to be preserved, babies' survival is important (Brosch et al., 2007). Therefore, baby faces are biologically significant stimuli, which our attention tends to prioritize (Brosch et al., 2007). Windhager et al. (2012) showed that this tendency can be generalized. In their research, when an object– thereto a car– met the baby face proportion criteria, it was rated as "child" by the participants.

On the other hand, gender recognition is of high evolutionary importance to humans, as it is crucial for procreation (Yamaguchi et al., 1995). Compared to females, males have a more protruding nose and jaw, as well as a larger head, that proportionally matches their larger body (Bruce et al., 1993). Given that the attribution of human characteristics to non–human agents is a generalization that protects the human species from under–detection of possible threats, it could be hypothesized that an object to which humanlike features have been ascribed is possible to be identified as masculine when it possesses pronounced traits, and as feminine when its features are softer and more inconspicuous. It should also be noted that, according to Perrett et al. (1998), more masculine faces– be them males or females– are perceived as more dominant. Thus, if we extend our hypothesis, it seems reasonable that objects with more pronounced traits, which, according to the previous statement, are considered masculine, could also be perceived as more dominant.

As has been stated above, a face can give consequential information for one's emotional state (Windhager et al., 2008), and emotional expressions are pivotal to interpersonal relationships (Ekman, 1999). The basic emotions according to Ekman (1993) are: sadness, anger, fear, happiness, disgust, and surprise. However, basic emotions are not a unique human trait, but one that a variety of living organisms have (Rodríguez-Torres, 2005). On the other hand, secondary emotions, such as jealousy, pride, embarrassment, shame, grief, guilt, and empathy,

are considered human–only traits (Rodríguez-Torres, 2005). This happens because, for secondary emotions to be elicited, there needs a certain amount of self–consciousness to be present, which is found mostly, if not solely, in humans (Morris et al., 2008).

Nevertheless, facial traits not only give important information about how someone is feeling, but they can also predispose us for their consequent behavior towards another being (Landwehr et al., 2011). An upward mouth, as well as a pair of curved eyes, indicate a happy face (Ekman, 1993). Contrarily, a downward mouth in combination with slit eyes, are indicative of an angry face (Ekman, 1993). The tendency of using facial traits to interpret one's emotional state seems to be generalized to objects, such as cars. According to Aggarwal and McGill (2007), humans tend to interpret an upward grille not only as a mouth, but as a smile. As smiling is considered a signal of friendliness in a universal scale (Kraut & Johnston, 1979), it could be hypothesized that an object that seems to be smiling, will be rated as more friendly too. Respectively, a face that shows anger conveys a message of having an intention to become aggressive (Zhang, 2018). Therefore, it could be assumed that an object whose shape forms an angry face, will be perceived as being hostile.

Facial traits are also used to draw conclusions about one's personality (Little & Perrett, 2010). Research findings indicate that when participants are asked to rate someone on features related to the Five factor model of personality (Norman, 1963) at a zero–acquaintance condition, they tend to have similar ratings among them, judging only by the target's appearance (Albright et al., 1988; Passini & Norman, 1966). This model comprises of the following factors: Openness to experience (related to curiosity, spontaneity, and willingness to learn; Major et al., 2006; McCrae & Costa, 1989), Conscientiousness (a tendency towards meticulousness, discipline, and a sense of responsibility; McCrae & Costa, 1989), Extraversion (linked to sociability and a

feeling of security; Barrick & Mount, 1991), Agreeableness (associated with trustworthiness, friendliness, and tolerance; Barrick & Mount, 1991), and Neuroticism (refers to the degree to which someone is nervous, depressive, irritated, embarrassed, emotional, insecure, and worried; Barrick & Mount, 1991). If the tendency to make inferences for someone's personality only by their appearance is combined to the tendency to anthropomorphize objects, it could be assumed that people will also attribute personality traits to objects, only by observing their features. This hypothesis was tested by Windhager et al. (2008), where they found consistent results regarding the attribution of personality traits to cars by the observation of their fronts, although the results were not consistent with regards to the factors of extraversion and conscientiousness.

So far, I have discussed the evolutionary aspect of anthropomorphism, but there is more to it than that. It seems that the relationship between humans and inanimate objects is modified through anthropomorphism, both in a cognitive and an emotional manner (Wan & Chen, 2020). More specifically, people usually develop an emotional relationship with the objects they own, which not only gives them a feeling of comfort and satisfaction (Wan & Chen, 2020), but also develops and reinforces their personal identity, as they often believe that the objects they own make them unique (Wan & Chen, 2020). Moreover, when devoid of human interaction, individuals feel that a threat is posed to their sense of belonging (Kwok et al., 2018; Mourey et al., 2017). Thus, attributing humanlike characteristics to inanimate agents might function as a substitute for a human relationship (Kwok et al., 2018; Mourey et al., 2017). Finally, anthropomorphizing can function as a self–confidence booster, which could result from the sense of having control over something (Wan & Chen, 2020).

However, people do not always manifest anthropomorphism. There needs to be a congruency between the object's features and the human category for anthropomorphizing to

take place. Simply put, for the object to be described in human terms, it should indeed have humanlike features (Aggarwal & McGill, 2007). When it comes to cars, this prerequisite is usually satisfied, due to their similarity with faces in the following areas: the windshield is like the human forehead in that they both belong in the upper part of the face/car, the headlights look like the human eyes as they are both part of the main body, oval–shaped, and symmetrical (Windhager et al., 2012). Both the human ears and the side–view mirrors are an extended part of the main body, and there are also some features that are positioned in the median plane of the body, one above the other, such as the nose and the car grille, as well as the mouth and the bumpers (Windhager et al., 2012). Nevertheless, the similarity of features between human faces and car fronts, is not always perceived in the same way; For example, Landwehr et al. (2011) attempted to show that the car grilles could be compared to the human mouth, a view also shared by Aggarwal and McGill (2007).

Despite the intriguing nature of this subject area, little research has been conducted regarding the attribution of human–like features in objects, especially cars. Kühn et al. (2014) found that the attribution of humanlike features to car fronts in non–edited photos, is linked to the activation of the brain region FFA (fusiform face area), which is also associated with human face processing and expertise, and it is found on the bottom surface of the temporal lobe. Windhager et al. (2010) presented edited photos of faces and cars to the participants of their research, two at a time, placed next to each other. They asked them to evaluate whether the cars and the faces presented had similar features (e.g., eyes, ears, nose). Using an eye–tracking technique, they noticed that when asked to compare face and car features, participants tended to fixate their eyes on specific regions. Thus, when comparing facial features to car features, the

car's headlights were perceived as eyes, the grille was considered to be a nose, the grille or the bumper were rated as a mouth, and the view mirrors as ears (Windhager et al., 2010).

Aggarwal and McGill (2007) investigated the circumstances under which consumers evaluate products positively or negatively, as a result of the marketers' efforts to present them as humans. The researchers attempted to prime a human schema, by presenting a car as describing itself. They also used a third–person description of the car, so that the object schema could be primed. Finally, based on a pretest where they found that a smiling face is considered as more human–like than a frown when rating a spokesperson, they edited the grille shape of the car, so that it would be upturned, like a smile, or downturned like a frown. This modification was used to include a feature that would be congruent (smile) or incongruent (frown) with the primed human schema. Results showed that the cars which were presented as humans and had human–like features (schema congruency) were evaluated more positively than the cars that were presented as humans but did not have human–like characteristics.

On a cross–cultural level, Windhager et al. (2012) presented to Austrian and Ethiopian participants standardized car front photos and asked them to rate the cars in a variety of human traits. These traits were linked to the following dimensions: biological features (child–adult, male–female), interpersonal relationships (friendly–hostile, submissive–dominant), basic emotions (sad, angry, afraid, happy, disgusted, surprised), personality factors (open, extroverted, agreeable, conscientious, neurotic). They also measured arousal, car liking, and two separate traits (contended, arrogant). The results showed a high consistency between the two populations in these scales: child–adult, submissive–dominant, and male–female. Participants used the same proportion criteria one uses to evaluate a human face.

The present study is greatly based on the research conducted by Windhager et al. (2012), serving as an enrichment of the existing knowledge on the matter of anthropomorphism. Participants were given photographs of car fronts, and they were asked to rate the cars depicted in a variety of human–like traits. In this research, we added secondary emotions in the evaluation of the cars, an aspect that is considered human–only (Rodríguez-Torres, 2005), and which, as far as we know, has not been investigated by other research studies. Participants were also requested to state whether they liked the presented cars, and if they would recommend any of them to a friend. We predicted that participants would attribute humanoid characteristics to the cars, based on the shape of the grilles, and that the stimuli would evoke different emotions in said participants, who will be more or less willing to suggest them for purchase.

Method

Experimental design–Variables

Ex post facto design was used for the experiment, as there was no manipulation of the stimuli, which were presented to the participants without any editing. The independent variable was the grille shape, which had two levels. In the first level, the grilles had an upturned bottom edge, along with a downturned upper edge, and in the second level they had an upturned bottom edge, along with a straight upper edge. The dependent variables were the anthropomorphic tendency (measured by the following scales: basic–secondary emotions, biological features, personality traits, interpersonal relationships), the type of emotion invoked to the participants by the stimuli, the intensity of the invocation, as well as their intention to suggest the corresponding car to a friend.

Stimuli

Participants were given an online survey via "SoSci Survey" (www.soscisurvey.de; Leiner, 2022), which was comprised of 20 car front photos, collected from the database of Evox Images® (www.evoximages.com). All vehicles, regardless of their shape or type, were white and photographed from the same angle, so that participants would not be influenced by the color of any given car, or the angle from which it was photographed.

The 20 stimuli were selected from a pool of 1500 car front photos. Of these, only 800 were white, all of which got classified in categories depending on their features, e.g., car size, as well as grille, bumper, and headlights shape. Subsequently, only the normal sized cars were selected for the survey, and a preliminary analysis was conducted, in order to find pairs of car front photos that were comparable. Thus, two groups of car front photos emerged, which differed only in the grille shape: in the first group (hereafter, Group A), the grilles had an upturned bottom edge, along with a downturned upper edge and in the second group (hereafter, Group B), they had an upturned bottom edge, along with a straight upper edge. All of the bumpers had a straight bottom edge along with a downturned upper edge, and all of the headlights had their inner side downturned. The bumpers and headlights shapes were kept steady for all the cars, due to the necessity to compare the car photos with respect to one variable. Therefore, a well–balanced distribution of the stimuli was created, resulting in 20 photos in total, 10 for each group, using python and scikit multilearn, which is a library built on top of the scikit–learn ecosystem (Szymański & Kajdanowicz, 2017).

Participants

Participants took part in this research voluntarily. They were recruited through posts on social media and were required to have normal or sufficiently aided visual acuity. Participants with neurological impairments, as well as those who had a professional interest in cars or showed high engagement in activities related to their cars, such as constant washing, repairing, or purchasing add–ons, were excluded from the survey. Originally, 23 participants took the survey, however two participants were excluded from the sample, as they did not meet the inclusion criteria. As a result, 21 males and females, aged between 19 and 36 ($M = 28.95$, $SD = 4.12$) participated.

Survey

The survey included demographic information, such as sex, age, level of education, current location, and car possession. Regarding car possession, participants were asked to specify the exact car brand they or their family owns and the frequency with which they engage in activities related to their car. Thus, any effects of familiarization accounting for anthropomorphizing tendencies could be controlled for.

Upon completion of the demographic information, participants proceeded to rate the car photos. More specifically, along with each car front photo, they were given a set of unipolar or bipolar scales. Regarding the unipolar scales, participants were asked to rate the emotional state conveyed by each car photo, using the basic emotions described by Ekman (1993), i.e., sad, angry, scared, happy, disgusted, surprised, as well as the secondary emotions, i.e., jealousy, pride, embarrassment, shame, grief, and guilt (Rodríguez-Torres, 2005). Although empathy is a secondary emotion too, it was not evaluated in this research since it is usually expressed during

interaction. The rationale behind the use of the aforementioned scales is that, as described above, the attribution of emotional states to cars is a sign of anthropomorphism, since it shows that they are perceived with terms typically ascribed to humans (Aggarwal & McGill, 2007).

The bipolar scales were related to biological features, as well as qualities linked to interpersonal relationships and personality traits. As per the biological features, we used the scales child–adult and male–female, because as stated above, age and gender discrimination are of great evolutionary importance to humans (Brosch et al., 2007; Yamaguchi et al., 1995). Due to this evolutionary significance, they have the tendency to discriminate between children and adults, males and females, only by observing their face proportions (Lorenz, 1943; Fink et al., 2005). Taking this into consideration, along with the fact that people tend to attribute human–like features to inanimate objects, we expected that participants would rate the cars as childish or mature, masculine, or feminine, depending on the traits the cars have. Furthermore, if, as stated above, a car is rated as masculine, it is possible that it would also be evaluated as more dominant, since more conspicuous traits are considered masculine, and masculinity is linked to dominance.

The reason behind the interpersonal relationships scales usage is that humans make inferences about one's intentions assessing their emotional state (Landwehr et al., 2011). Given that inanimate agents cannot be friendly or hostile, this trait can only be attributed to living beings, such as humans. Thus, if participants rate the cars as being friendly or hostile, it means that they use animate terms to describe non–living agents. Moreover, considering that smiling is universally associated with friendliness (Kraut & Johnston, 1979), and anger is linked to aggression (Zhang, 2018), we expect that whoever rates a car as "happy" or "angry", will also describe it as being "friendly" or "hostile" respectively.

An additional scale of the survey was based on the Five factor model of personality (Norman, 1963). As mentioned above, individuals tend to make inferences about someone's personality, only by observing their facial traits. We speculate that if participants anthropomorphize cars, they will attribute personality traits to them too. Therefore, we included items that correspond to the Five factor model of personality in the survey, namely openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Norman, 1963). These items examined whether the cars seem curious or cautious (for openness to experience), organized or careless (for conscientiousness), energetic or reserved (for extraversion), compassionate or rational (for agreeableness), and nervous or confident (for neuroticism).

Lastly, participants were asked to state whether each car image evoked a positive or negative emotion in them, as well as if they felt sleepy or excited, depressed or happy, when looking at those images. These metrics were used to classify the emotions felt by the participants, using the circumplex model of affect developed by Russell (1980). This framework posits that each emotion can be understood as a combination of two factors: valence and arousal (Lang et al., 1993; Posner et al., 2005; Russel, 1980;). Valence is used to evaluate whether a certain stimulus is pleasant or unpleasant, whereas arousal reflects a state of calmness or alertness (Lang et al., 1993). These factors guide our subsequent feelings, eliciting behaviors of approach or avoidance, and make it easier for the participants to explain and describe their emotions (Posner et al., 2005). Furthermore, participants were asked to state the degree to which they liked each car, as well as their potential intention to recommend it to a friend. It should be noted that all of the participants answered the same questions, which were presented in different order for each stimulus, so that order effects bias could be avoided.

Procedure

Once participants clicked the link of the survey, they were presented with a welcome note, which informed them about the researcher, the University, and the purpose of the survey. They were also assured that their participation would be anonymous, and that their information would be kept for research reasons only, without being shared with any third party. Following this, car images were displayed in random order on their computer screen, each of which was accompanied by the survey questions. Upon completion of the experiment, they were thanked for their participation and were given the researcher's contact information in case they wished to be debriefed.

Results

A multivariate analysis model was used in SPSS 29 to assess the effect of levels of car grille group on basic and secondary emotions. Of the two types of grilles, only car grille A had an effect on basic and secondary emotions. More specifically, car grille A led to a lower level of Hardly surprised–Very surprised [b= -11.300, $F(1, 418) = 7.994$, $t = -2.827$, $p = 0.005$], Hardly ashamed–Very ashamed [b= -11.300, $F(1, 418) = 18.425$, $t = -4.292$, $p < 0.001$], and Hardly embarrassed–Very embarrassed [b= -11.562, $F(1, 418) = 18.878$, $t = -2.827$, $p < 0.001$]. In contrast, higher values of Hardly proud–Very proud [b = 16.638, $F(1, 418) = 32.935$, $t = 5.739$, $p < 0.001$] and Hardly angry–Very angry [b = 24.081, $F(1, 418) = 71.779$, $t = 8.472$, $p < 0.001$] were associated with car grille A. The rest of the scales did not reach statistical significance. The results are presented in Table 1.

Table 1. Multivariate analysis to assess the effect of basic and secondary emotions

Dependent Variables	**Independent Variable**	**B**	**t**	**p-value**	**95% CI**		**F(df_1,df_2)**	**Mean Square Error**
Hardly surprised-Very surprised	Car grill A	-7.986	-2.827	**0.005**	-13.537	-2.434	7.994(1,418)	6696.021
Hardly jealous-Very jealous	Car grill A	-0.771	-0.271	0.786	-6.361	4.818	0.074(1,418)	62.486
Hardly sad-Very sad	Car grill A	-6.148	-2.327	0.020	-11.340	-0.955	5.417(1,418)	3968.288
Hardly disgusted-Very disgusted	Car grill A	-0.533	-0.190	0.850	-6.057	4.990	0.036(1,418)	29.867
Hardly ashamed-Very ashamed	Car grill A	-11.300	-4.292	**<0.001**	-16.475	-6.125	18.425(1,418)	13407.45
Hardly embarrassed-Very embarrassed	Car grill A	-11.562	-4.345	**<0.001**	-16.793	-6.331	18.878(1,418)	14036.152
Hardly scared-Very scared	Car grill A	-11.981	-4.371	**<0.001**	-17.369	-6.593	19.103(1,418)	15072.038
Hardly grief-stricken-Grief-stricken	Car grill A	-3.629	-1.375	0.170	-8.817	1.560	1.89(1,418)	1382.486
Hardly happy-Very happy	Car grill A	-1.486	-0.511	0.610	-7.200	4.229	0.261(1,418)	231.771
Hardly proud-Very proud	Car grill A	16.638	5.739	**<0.001**	10.939	22.337	32.935(1,418)	29066.752
Hardly angry-Very angry	Car grill A	24.081	8.472	**<0.001**	18.494	29.668	71.779(1,418)	60888.688
Hardly guilty-Very guilty	Car grill A	-2.433	-0.857	0.392	-8.013	3.146	0.735(1,418)	621.717

A multivariate analysis model was run in SPSS 29 to assess the effect of Big 5 Personality traits, biological features, and interpersonal relationships. Of the two types of grilles, only car grille

A had an effect on said dependent variables. In particular, car grille A led to a lower level of Organized–Careless [b= -5.962, $F(1, 420) = 5.125$, $t = -2.264$, $p = 0.024$], Energetic–Reserved [b= -18.7, $F(1, 420) = 53.359$, $t = -7.305$, $p < 0.001$], Masculine–Feminine [b= -13.162, $F(1, 420) = 27.319$, $t = -5.227$, $p < 0.001$], and Dominant–Submissive [b= -21.014, $F(1, 420) = 77.976$, $t = -8.83$, $p < 0.001$]. Contrarily, higher values of Nervous–Confident [b = 11.276, $F(1, 420) = 19.489$, $t = 4.415$, $p < 0.001$], Child–Adult [b= 20.695, $F(1, 420) = 58.938$, $t = 7.677$, $p < 0.001$], and Friendly–Hostile [b = 18.686, $F(1, 420) = 54.693$, $t = 7.395$, $p < 0.001$] were linked to car grille A. The rest of the scales did not reach statistical significance. The results are presented in Table 2.

Table 2. Multivariate analysis to assess the effect of Big 5 Personality traits, biological features and interpersonal relationships

Dependent Variables	Independent Variable	B	t	p-value	95% CI		$F(df_1,df_2)$	Mean Square Error
Organized-Careless	Car grill A	-5.962	-2.264	**0.024**	-11.139	-0.785	5.125(1,420)	3732.152
Nervous-Confident	Car grill A	11.276	4.415	**<0.001**	6.255	16.297	19.489(1,420)	13351.010
Compassionate-Rational	Car grill A	0.038	0.014	0.988	-5.131	5.208	0(1,420)	0.152
Curious-Cautious	Car grill A	0.024	0.009	0.993	-5.123	5.171	0(1,420)	0.060
Energetic-Reserved	Car grill A	-18.7	-7.305	**<0.001**	-23.732	-13.668	53.359(1,420)	36717.450
As being masculine-As being feminine	Car grill A	-13.162	-5.227	**<0.001**	-18.112	-8.212	27.319(1,420)	18189.752
Like a child-Like an adult	Car grill A	20.695	7.677	**<0.001**	15.396	25.994	58.938(1,420)	44970.752
Dominant-Submissive	Car grill A	-21.014	-8.83	**<0.001**	-25.692	-16.336	77.976(1,420)	46368.021

Friendly-Hostile	Car grill A	18.686	7.395	**<0.001**	13.719	23.652	54.693(1,420)	36661.371

A multivariate analysis model was conducted in SPSS 29 to evaluate the effect of affect and intention to buy, which showed that only car grille A had an effect on the aforementioned variables. Specifically, car grille A led to a lower level of car liking [b= -0.195, $F(1, 418) = 7.255$, $t = -2.694$, $p = 0.007$], but higher values of Sleepy–Excited [b = 12.852, $F(1, 418) = 31.368$, $t = 5.601$, $p < 0.001$], and Depressed–Happy [b= 7.210, $F(1, 418) = 12.189$, $t = 3.491$, $p = 0.001$]. The scales "It evoked pleasant feelings–It evoked unpleasant feelings", as well as "Intention to buy" did not reach statistical significance. The results are presented in Table 3.

Table 3. Multivariate analysis to assess the effect of affect and intention to buy.

Dependent Variables	**Independent Variable**	**B**	**t**	**p-value**	**95% CI**		**F(df_1,df_2)**	**Mean Square Error**
Sleepy-Excited	Car grill A	12.852	5.601	**<0.001**	8.342	17.363	31.368(1,418)	17344.288
Depressed-Happy	Car grill A	7.210	3.491	**0.001**	3.150	11.269	12.189(1,418)	5457.610
It evoked pleasant feelings-It evoked unpleasant feelings	Car grill A	-4.414	-1.832	0.068	-9.151	0.322	3.356(1,418)	2046.021
Did you like this car?	Car grill A	-0.195	-2.694	**0.007**	-0.338	-0.053	7.255(1,418)	4.002
Intention to buy	Car grill A	-0.057	-0.720	0.472	-0.213	0.099	0.518(1,418)	0.343

Discussion

The current study was greatly based on Windhager et al. (2012), the difference between the two studies being the addition of the secondary emotions scale, that is, jealousy, embarrassment, shame, guilt, and grief, which are considered human-only traits (Rodríguez–Torres, 2005). The rationale behind this study was that the phenomenon of anthropomorphism emerges from humans' need to adjust to their environment (Gibson, 1966; 1979). Thus, they tend to attribute facial traits, personality traits, emotions, and intentions, typically ascribed to humans, to non–living agents. As it has been stated, this tendency serves several purposes, among which, detection of threatening stimuli, and social interaction facilitation.

In the present study, participants were required to rate 20 car images in a variety of scales that included biological features, basic and secondary emotions, personality traits and interpersonal relationships. They were also asked to evaluate the emotion each car evoked in them, as well as whether they liked it and intended to suggest it for purchase. The stimuli were divided into two groups: group A and group B, which only differed in the grille shape.

Biologically, participants rated the cars as being masculine, adults, and dominant. Regarding masculinity, it should be noted that cars which belonged to group A had more pronounced traits compared to those that belonged to group B. Protruding traits are a sign of masculinity (Bruce et al., 1993), thus it is reasonable that no car was rated as female–like, since an evaluation like this would require softer features in comparison. This finding supports our hypothesis that humans not only tend to proceed to face recognition when seeing a human face, but they also generalize this tendency to non–living organisms, such as cars. Moreover, of the statistically significant results, no stimulus met the baby face proportion criteria, so none was rated as being child–like, since they possessed more "mature" features instead. Cars of group A

were also considered as being dominant, a finding that is in accordance with Perrett et al. (1998), who stated that masculine faces are perceived as such. This finding further supports our hypothesis that humans manifest anthropomorphic tendencies, since not only do they categorize facial traits by observing other humans' appearance, but they do so with objects –hereto, cars– as well.

With regards to basic and secondary emotions, the results showed that cars which belonged to group A seemed proud and angry to the participants. Results for surprise, sadness, shame, embarrassment, and fear were also statistically significant, but the participants did not see the corresponding emotions in the car fronts, as opposed to pride and anger. It seems that participants perceived the cars as expressing one basic emotional state (anger) and one secondary emotional state (pride). The existence of both basic and secondary emotions may be indicative of anthropomorphic tendencies, since basic emotions are present in a wide range of organisms, including humans, and secondary emotions are manifested exclusively in human beings (Rodríguez–Torres, 2005). Nonetheless, the perception of two emotions only is not sufficient to support the existence of the phenomenon in a wide range. It should be noted that the same group of stimuli that was rated as being masculine, was also evaluated as angry and proud. One possible interpretation is the following: It has been found that gender stereotypes surround the emotions of anger and pride, as men are thought to experience and express more often these emotions than women (Plant et al., 2000), a finding that makes reasonable the link between masculinity and said emotions.

Moreover, since cars of group A were evaluated as angry, they may have conveyed an aggressive intention (Zhang, 2018), since participants perceived them as being hostile too, supporting this hypothesis as well. Cars of group A had a grille whose upper edge was

downturned, whilst their bottom edge was upturned, their bumper had its upper edge downturned, along with a straight bottom edge, and the headlights resembled slit eyes; these traits account for the "angry" rating (Ekman, 1993). This evaluation could explain the distaste expressed by the participants towards the presented cars, as they responded negatively to the questions concerning car liking. However, as stated above, perceiving emotional states in human faces can help humans develop interpersonal relationships (Ekman, 1999). Although in this study participants did not perceive a wide range of emotions when looking at the presented cars, it would be interesting if future studies investigated whether the perception of a multitude of different emotions in car fronts alters the type of the emotional relationship humans form with them.

Additionally, it appears that participants attributed personality traits to cars that belonged to group A. The analysis showed that statistically significant results emerged from the scales Organized–Careless (conscientiousness), Nervous–Confident (neuroticism), and Energetic–Reserved (extraversion). More specifically, the cars of group A seemed organized, confident, and energetic. Since the traits that correspond to the five–factor model are used to describe a human's personality, it seems that people tend to overgeneralize this behavior to cars (Zebrowitz, 2003), as they are inclined to make inferences not only for a person's personality, but also for a car's personality, although cars are not living organisms. This finding also strengthens the hypothesis that people tend to perceive anthropomorphic features in inanimate agents.

Although this study offered some understanding with regards to the manifestation of anthropomorphism in cars, it also has several notable limitations. The sample size was small and consisted of young adults, which probably makes it non applicable both to a larger population and a wider age range. Future studies should include larger and more diverse samples so that the

results can be more safely generalized. Furthermore, the cars whose pictures were used as stimuli shared the shape of headlights and bumpers, both of which had only one level, namely, inner side downturned and straight bottom edge–downturned upper edge, respectively. This design makes it possible to compare the car groups regarding one variable only–here, the grilles–, for the reason that the rest of the variables are kept steady. However, the results extracted would be more informative if the grilles compared varied greater in size and shape, as well as if more car components were compared, following the same type of design. Thus, future studies should include a multitude of classes for each car feature, as well as more classes for the grilles shape.

Results from this and future studies could provide some insights concerning marketing. If future studies use car fronts whose grilles, bumpers and headlights have a greater variety of shapes and sizes, researchers may more accurately identify those shapes and sizes of the distinct components of car fronts that make a consumer more willing to buy a certain car. Emotions are crucial when it comes to car purchases, since affective design is complementary to functional design in customer satisfaction (Helander et al., 2013). Although the present study did not provide any significant insights concerning the intention of the participants to suggest the cars in question for purchase, it did provide us with the information that they did not like the cars of group A, probably due to the perceived hostility they elicited. Thus, a greater variety of cars is required so that approach and avoidance consumer tendencies could be predicted with greater accuracy.

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Appendix

Group A

Stimulus 6725

Stimulus 8011

Stimulus 10569

Stimulus 10737

Stimulus 12037

Stimulus 12813

Stimulus 13064

Stimulus 13697

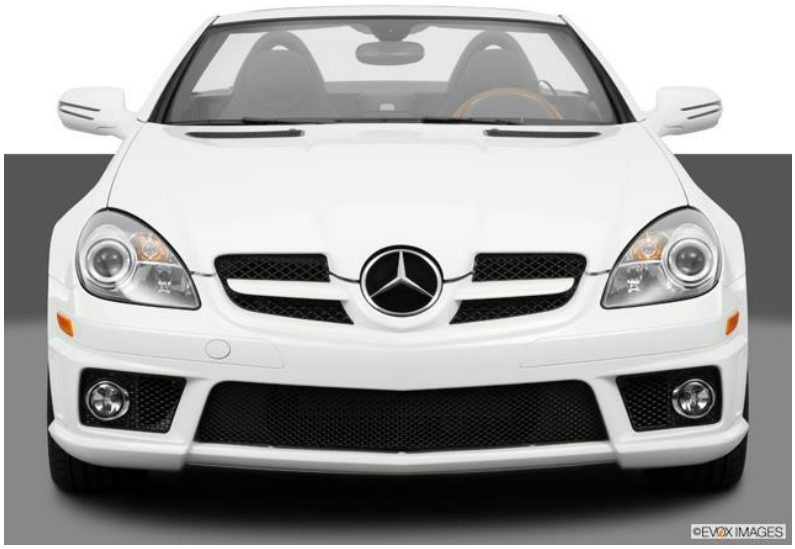
Stimulus 14059

Stimulus 14142

Group B

Stimulus 5541

Stimulus 6028



Stimulus 6996

Stimulus 7164

Stimulus 7371

Stimulus 7698

Stimulus 7882

Stimulus 7995

Stimulus 9587

Stimulus 10446