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Original Article

"Cars have their own faces": cross-cultural ratings of car shapes in biological (stereotypical) terms

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Abstract

It was recently shown that Austrians associate car front geometry with traits in a way that could be related to face shape geometry mapping to those same overall suites of traits. Yet, possible confounding effects of familiarity with the car models, media coverage and entertainment could not be ruled out. In order to address this, the current study uses a cross-cultural comparison. Adult subjects in two countries (Austria and Ethiopia, *n*=129) were asked to rate person characteristics of 46 standardized front views of automobiles on various trait scales. These two countries differ substantially with regard to their experience with car models and brands, as well as car marketing and media coverage. Geometric morphometrics was then used to assess the shape information underlying trait attribution. Car shapes for perceived maturity, maleness and dominance were highly similar in both countries, with patterns comparable to shape changes during facial growth in humans: Relative sizes of the forehead and windshield decrease with age/growth, eyes and headlights both become more slit-like, noses and grilles bigger, lips and air-intakes are wider. Austrian participants further attributed various degrees of some interpersonal attitudes and emotions, whereas neither Austrians nor Ethiopians congruently ascribed personalities. Morphological correlates of personal characteristics are discussed, as are person perception and its overgeneralization to inanimate objects. Cross-cultural similarities and differences are addressed, as well as implications for car styling, follow-up studies on driving and pedestrian behavior, and fundamental dimensions in inference from (human) faces.

Keywords: Behavioral anthropology; Geometric morphometrics; Cross-cultural overgeneralization; Facial shape

1. Introduction

Recently, Windhager et al. (2008) showed that people in Austria attribute person-like traits to cars based on the shape of cars and their constituent parts in a way that mirrors these attributions to people and animals. Yet, the authors were not able to rule out possible influences of familiarity with these car models, with automobile advertisements, brand stereotypes, anthropomorphic cars in movies and the like. The current study extends this work to a cross-cultural perspective with Ethiopia as a reference country. In Ethiopian rural areas, participants are not exposed to either the brands or car models under study or even any kind of car marketing and advertisement. Quite the opposite holds true for most parts of Europe, the United States and large industrial centers around the world.

Human and animal faces convey much essential information in contexts ranging from predation to social interaction. Organisms gain much from being right (e.g., identification of predator, prey, conspecifics) and lose little when accidentally treating a nonagent as an agent. As an example, taking a bear for a stone might be lethal, whereas the opposite does not harm. This asymmetry in the costs of errors might have led to a perception bias (error management theory; Guthrie, 1993; Montepare & Zebrowitz, 1998; Nettle, 2004). Increasing sensitivity to the relevant

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features and configurations in the course of evolution might have resulted in contemporary mechanisms for the interpretation of faces that are activated not only by real faces and their photographs, but also by abstract representations (schematic faces: e.g., Keating, Mazur, & Segal,, 1977; Senior et al., 1999) and that might extend even to car cartoons (cf. Pittenger, Shaw, & Mark, 1979). This may be a version of Sperber's (1994) process of extending an “actual” (evolutionarily salient) domain into a “proper” (cognitively conformal) domain.

Applying the rules of person perception to shapes with the same general structure as a face or body has been shown by the systematic manipulation of a Volkswagen (VW) Beetle cartoon (Pittenger et al., 1979). The same algorithm applied to other objects such as shoes and armchairs did not lead to comparable trait attributions (Mark, Shaw, & Pittenger, 1988). Thus, a certain degree of schema congruity seems to be a prerequisite for the overgeneralization from faces to objects (Aggarwal & McGill, 2007). The level of congruity is the extent to which features of an entity match those of a category schema, in our case (human or mammal) faces. Both cars and faces are bilaterally symmetric to a vertical axis with a visually separated upper part (forehead, windshield), an ellipsoid on each side of the main body (eyes, headlights) and two extensions (ears, side-view mirrors), as well as two features in the midline one above the other (nose/grille, mouth/additional air-intake).

The analogy between automobiles and facial shape is already suggested (and depicted) in Coss (2003) and in Enlow's (1975) textbook on facial growth. Intuitively assessed similarities confront us every day in car advertisements, news coverage and entertainment media (e.g., Disney Pixar's “Cars” or Disney's VW Beetle “Herbie” movies) — exploiting our tendency to anthropomorphize nonhuman agents the more similar they are to human physical appearance and motion (Morewedge, Preston, & Wegner, 2007; Waytz, Epley, & Cacioppo, 2010).

Given the evolutionary significance of a correct interpretation of another's biological state and intention, it is apparent that morphological distinctions are the ones that drive age attribution (Montepare & Zebrowitz, 1998, for a review) and sex discrimination (Brown & Perrett, 1993), as well as the attribution of femininity, masculinity (Bruce et al., 1993) and associated traits such as strength, submissiveness and dominance (e.g., Grammer & Thornhill, 1994; Todorov, Said, Engell, & Oosterhof, 2008). Children have a relatively larger forehead, thin and arched brows, larger eyes, shorter noses as well as a smaller mid and lower face compared to adults (Bulygina, Mitteroecker, & Aiello, 2006; Enlow & Hans, 1996; Trenouth & Joshi, 2006), and most adult facial sexual dimorphism involves the same features that constitute the difference between children and adults (Schaefer, Mitteroecker, Gunz, Bernhard, & Bookstein, 2004; Weston, Friday, & Liò, 2007). There is recent and fairly convincing evidence that perceptions of age and perceptions of masculinity relate to very similar features in the face (Boothroyd et al., 2005). Todorov and collaborators (2008) describe dominance alongside trustworthiness as one of two dimensions in the spontaneous characterization of faces. The link of social dominance and (perceived) physical body size has just been empirically confirmed (Marsh, Yu, Schechter, & Blair, 2009). Williams and colleagues (1999) found that women relative to men are regarded as soft and submissive (Ashmore & Tumia, 1980; Hess, Adams, & Kleck, 2005) in a pancultural study including 25 nations. Artificially masculinized male and female faces are perceived to be more dominant, masculine and older (Perrett et al., 1998). Guthrie (1970) even speculates that the protruding male chin in the human species was selected as a sexual signal and thus exceeds the functional necessity of food processing.

Ecological theory (summarized in Montepare & Zebrowitz, 1998) provides a useful theoretical framework for the investigation of accurate perception and behavior as well as for overgeneralization as an evolutionarily beneficial strategy. The three relevant tenets are as follows: (1) Social perceptions serve biologically and socially adaptive functions. Although this favors the expectation of increased accuracy, it does not preclude errors, especially if there might be a greater advantage in overdetection (cf. error management theory; Guthrie, 1993; Montepare & Zebrowitz, 1998; Nettle, 2004). (2) Social judgments are informed by perceptible stimulus qualities, and overgeneralization effects will occur when qualities typical of one context occur in another. (3) People's physical qualities reveal affordances, which are the opportunities for acting or interacting, and are linked to behavioral tendencies.

Pittenger and colleagues (1979) modeled a drawing of a VW Beetle front and a cartoon version including painted facial features in line with a mathematical simulation of growth — the cardioidal strain algorithm — and asked undergraduates of an American university for relative age attributions. The ratings were found to correlate positively with expectations from the modeling. Windhager et al. (2008) extended this approach in Austria by the use of natural-looking, existing car models, a broader list of rated traits (including sex, interpersonal attitudes, emotions and personality) and the actual measurement of car shape and its constituent parts. If there is a biologically based overgeneralization from faces to cars, then the biomorphic aspects of such a visual stimulus should be broadly recognized even if the actual object is not. We are saying that to be recognized as a face may well be a biologically based affordance of cars. Cross-cultural agreement would therefore be a prerequisite for supporting theoretical assumptions such as schema congruity and error management theory. Thus, the primary purpose of the present study was to test whether this shape–trait correspondence generalizes across cultures (and especially to a culture that is not exposed to car marketing, has little exposure to the film industry, etc., such as found in regions of Ethiopia).

Generalizability requires confirmation that:

- the correlation between Austrian and Ethiopian mean ratings is high, and
- the predicted car shapes for a specific trait attribution are similar.

From Pittenger et al. (1979) and from the structure of the first principal component of trait attribution and the corresponding car shape of the Windhager et al. 2008 study, we predict that (1) at least the biomorphic aspects of maturity, sex and interpersonal attitudes should generalize cross-culturally with (2) perceived maturity showing the strongest signal and (3) that maturity, sex and dominance attributions have a single factor in common. If there is such a single factor, car shapes estimated from these three qualities will be similar for the three scales and the two countries.

2. Materials and methods

2.1. Participants

The current study was based on three data sets (Austria, prestudy Ethiopia 2008 and comparative sample Ethiopia 2009). Their characteristics are summarized in Table 1. The Austrian sample was different from the study published in 2008 (Windhager et al., 2008). Data were collected in the capital of Austria, Vienna, and in rural villages and surrounding areas 30 to 45 km from the capital of Ethiopia, Addis Ababa (in 2008: Dukem, Holeta Genet, Laga Tafo and Sululta; in 2009: Holeta Genet, Sululta and two sites in Debre Zeit). Participants in Austria were recruited through online advertisements and in Ethiopia through local assistants. In Ethiopia, taking both years together, 11 of 89 participants reported having a driver's license and 6 claimed to own a car. The abrupt rise in the amount of compensation from 2008 to 2009 (Table 1) was necessary due to high inflation.

2.2. Stimuli

As in the preceding study, all pictures stem from computer renderings of high-resolution, realistic 3D digital models. The major advantage of this stimulus source is that materials, light and positioning can be better standardized than in any real-life situation (in 3ds Max from Autodesk Media & Entertainment, San Rafael, CA, USA). The digital mockups were scaled to the size of the original cars and colored silver, and the license plates were erased (Fig. 1). For a realistic appearance, materials such as car paint, chrome, rubber and glass as well as shadows were added. A virtual sun was placed at a 45° angle right in front of the car. A virtual camera with a 200-mm lens was positioned on the midline in front of the car at 12-m distance and half the height of the car (illustrated in Fig. 1).

We engaged in such standardization efforts because we were interested in the response to the *shape* of the car front and its constituent parts. All other differences such as reflections, optical distortions (through different lenses and distances), slight differences in positioning of the car to the camera or different colors of the car body might obscure the signal and hinder the interpretation. We used the stimuli of the previous study and added eight new ones. A detailed list of the models (all from 2004 to 2007) from 26 different brands is given in Appendix A.

2.3. Questionnaire and procedure

Each participant was asked to rate each car on 19 trait scales before the next car was presented. All 46 cars were presented in random order for each person. As the human face is a multisignal system from which humans can immediately infer information on age, sex, attitudes, personality traits and emotions, we wanted to cover this variety of possible inferences when testing trait attributions to car fronts. All rating scales were continuous and ranged from 0 to 100 (values and ticks not visible). The first four were bipolar [the biological features: child–adult and male–female; the two main dimensions of interpersonal relationships (Argyle, 2002): friendly–hostile and submissive–dominant]. In order to prevent artifacts from a possible

Table 1
Key data of the three samples

Data collection			Participants						
Location	Date	Researcher	Women	Men	Age range	Average (A)/ median (M) age [years]	S.D./quartile (Q) of age	Profession	Compensation
Austria	February and March 2007	S.W.	20	20	20–29 years	A: 23.5	S.D.: 2.6 years	3/4 student	10 Euro
Ethiopia (prestudy)	February 2008	K.S., S.W.	21	21	19–45 years	A: 28.1 M: 27.5	S.D.: 6.0 years 1st Q: 23 years 3rd Q: 32 years	>1/3 student or teacher	30–50 Ethiopian Birr
Ethiopia (comparative sample)	April 2009	K.S., S.W.	23	24	17–59 years	A: 27.0 M: 23.0	S.D.: 10.4 years 1st Q: 20 years 3rd Q: 32 years	>1/3 student or teacher	80 Ethiopian Birr

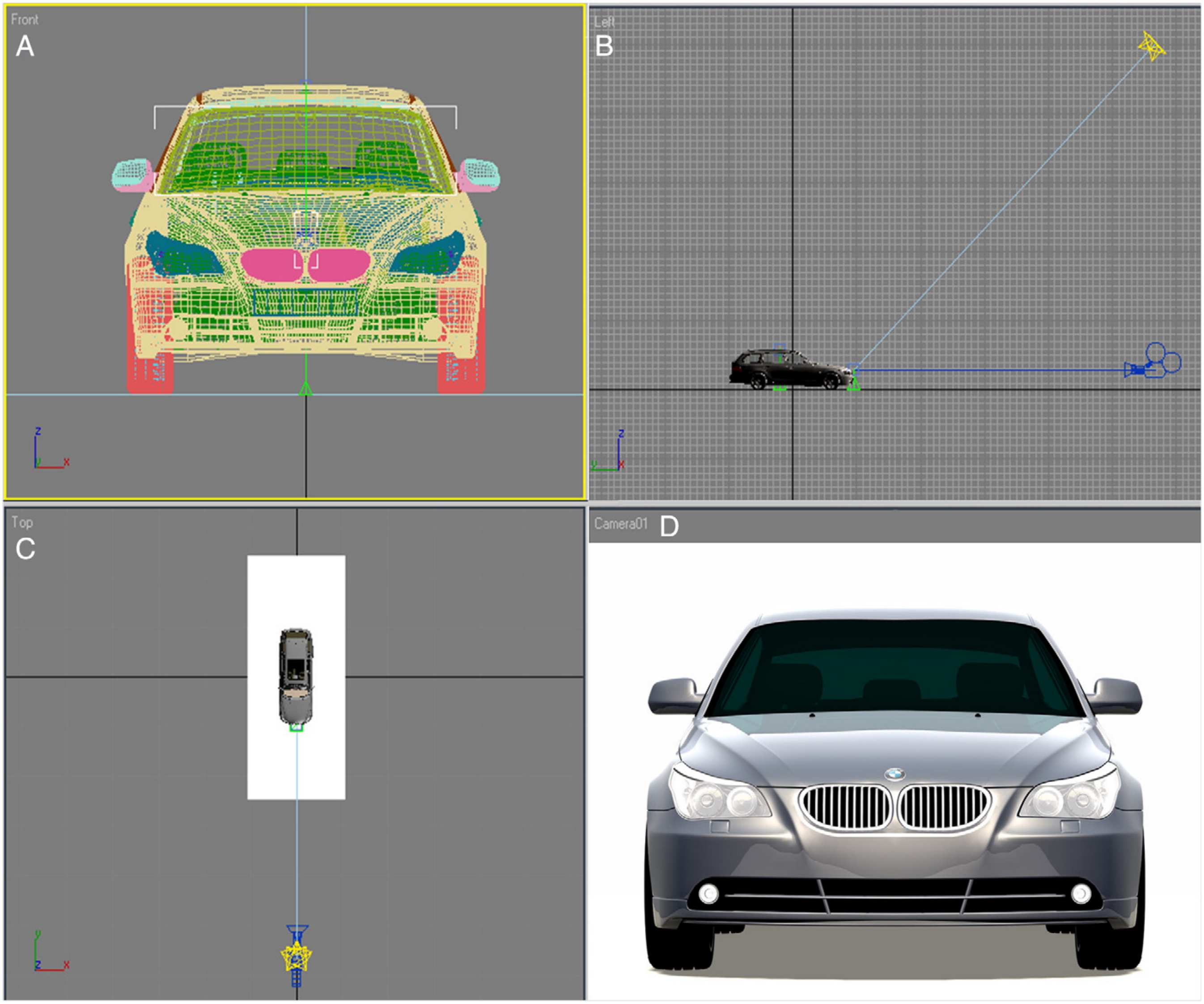

Fig. 1. Preparation of the standardized car stimuli. Customary true-to-detail digital mockups of car models from 2004 to 2007 of 26 brands (example in the upper left panel (A)) were edited in 3ds Max (Autodesk Media & Entertainment, San Rafael, CA, USA) to face a virtual camera (in blue) at half the height of the car exactly frontally (B and C). A virtual sun (in yellow) produces symmetric reflections and shadows on the material to give the car a realistic appearance. The lower right picture (D) shows the camera view after rendering. These are the pictures that were presented in the rating experiment.

side bias, the direction of the “sex” scale, with “male” (0) on the left and “female” (100) on the right side, was not in line with the other scales (in the sense of a social signal where perceptions of adulthood, maleness and dominance go together). We reversed this scale prior to data analyses to present the results more intuitively. The other scales were unipolar, ranging from “not at all” to “a lot/very much”. These remaining 15 items were (in the order on the questionnaire): the six so-called basic emotions (Ekman, 1999) — sad, angry, afraid, happy, disgusted, surprised; the five cross-culturally valid personality factors (McCrae & Costa, 1997) — open, extroverted, agreeable, conscientious, neurotic; two items that resulted from discussions with the automotive industry — contented, arrogant; as well as “aroused” to account for the dimensional approach to emotions by Russell (e.g., Russell, 1997) and, finally, “I like the car”. Cross-cultural comparisons were of averages for each dimension by car and country. Subjects who were acquainted with the use of a computer mouse worked on a computer interface (all participants in Austria, 17% in 2008 and 19% in 2009 in Ethiopia); the others responded on a paper-and-pencil version. The color printouts of the cars, in the latter case, were presented vertically to match the presentation of the screen.

In Austria, we used the following instructions (translation from German): “This is a simple rating experiment. Please describe your impression of the shown car front by moving the slider to the left or the right”. The experimenter stayed with the subject until the first ratings were completed to ensure that the task and the interface were understood. In the prestudy Ethiopia 2008, we used the following introductory sentences in English and Amharic, the official language of Ethiopia: "Please tell us: How does this car look? There is no right or wrong answer, just your opinion counts!" As 71% of participants in 2008 reported Oromo as their mother tongue, we decided to add translations into this language. We also felt the need for a more detailed introduction. The revised version for 2009 was: "You will see different car fronts. This study is not about function of the car or whether you would like to have it or not, but only about how you think it looks. Please do not try to be polite, but mark your personal, honest impression." The items on the 19 scales were presented in German in Austria, in Amharic and English in Ethiopia 2008 and in Amharic, English and Oromo in Ethiopia 2009. Each questionnaire was translated back and forth by three Ethiopian native speakers fluent in at least two Ethiopian languages, English and/or German. Much personal communication took place to ensure that not only the items but also the concepts behind them translate well into the other languages. The follow-up questionnaires included demographic questions as well as questions on car ownership, car use and "dream" cars. Finally, our subjects were debriefed, paid and thanked for their cooperation.

2.4. Excluded and missing data

Each participant was asked to rate 46 car fronts on 18 traits and their degree of liking. From the Austrian sample, we had to omit data from two men for reasons of obvious problems with the rating scheme. Furthermore, the ratings of four cars from another subject were not considered because all values were defaulted. In the Ethiopian sample of 2008, we excluded the data of three men and two women using paper and pencil because their seriousness or comprehension of the task was questionable from visual inspection (e.g., zigzag patterns across the page instead of rating the pictures). Furthermore, in nine cases, all ratings of one car by a single subject could not be taken into account due to missing data. Of the remaining 32,167 data entries (meaning the rating of one subject on one scale for one car), 173 were missing (0.5%) and omitted. In the 2009 Ethiopian sample, one woman left after rating 22 cars. From the remaining 36,252 data points, 327 were missing data (0.9%) because subjects left the scale of a certain variable blank, made two markings on the same scale or forgot to rate a specific car, and the like. Again, such suspect or missing data were omitted from subsequent analyses.

2.5. Statistical analyses and geometric morphometrics

Pearson correlation coefficients, bivariate linear regressions, plots and significance tests, and descriptive statistics were computed in SPSS 15. All tests were two-tailed. Pearson correlation coefficients equal to or larger than 0.3 are statistically significant at the .05 level for our sample size of 46 automobiles.

A geometric morphometrics approach was used to link the ratings to car shape. Recent reviews of these methods can be found in Mitteroecker and Gunz (2009) and, in connection with perception data, in Schaefer and colleagues (2009). The great advantage of geometric morphometrics is that the results of statistical analyses are in terms of coordinates so that corresponding shapes can be visualized. The form of each car was captured by the two-dimensional Cartesian coordinates of 34 landmarks that were described in detail in the preceding publication (Windhager et al., 2008). Shape information invariant to scale and position was extracted by Generalized Procrustes Analysis (Rohlf & Slice, 1990). The superimposed configurations were then entered as dependent variables in a multivariate regression with the averaged rated trait scores as the independent variable ("shape regression"). The estimated shape changes from the average car to a car that is rated as more childlike, adult, female, male, etc. were visualized through deformation grids based on the thin-plate spline interpolation function (Bookstein, 1991). For illustrative purposes, outline landmarks were connected with straight lines. Permutation tests based on 1000 permutations were used as the test statistic (Good, 2000). In terms of computer programs: landmark coordinates were digitized in tpsDig2 Version 2.12 (Rohlf, 2008), shape regressions and permutation tests were computed in tpsRegr Version 1.36 (Rohlf, 2009), and thin-plate spline deformation grids were generated using Mathematica 6. All figures were edited in Adobe Illustrator CS3.

3. Results

3.1. Cross-cultural comparisons: correlations

Magnitudes of Pearson correlation coefficients were used to assess the strength of association between the Austrian and Ethiopian mean ratings per car for each trait. The sample size equals the total number of stimuli, i.e., 46, for all subsequent analyses. With the Ethiopian prestudy data from 2008, we obtained a strong positive correlation of 0.75 for the child–adult dimension (see also Windhager et al., 2009), whereas all other coefficients fell below 0.36.

When the Austrian and the Ethiopian sample of 2009 were considered, we observed strong, significant positive correlations not only for child–adult (r=0.85) but also for female–male (r=0.75) and submissive–dominant (r=0.84) ratings. All p values were below 2.7×10^{-9} so that we abandoned explicit Bonferroni adjustments. The correlation coefficients for the other scales remained below 0.57 (arrogant, see Fig. 3), followed by 0.43 (afraid) and 0.36 (sad), raising an issue that is considered later. Scatterplots visualizing the association of Austrian and Ethiopian 2009 mean ratings for child–adult, female–male and submissive–dominant are presented in Fig. 2. Taking the Austrian subjects as the reference sample, we found coefficients of determination (R^2) of 0.72, 0.56 and 0.71, respectively. As

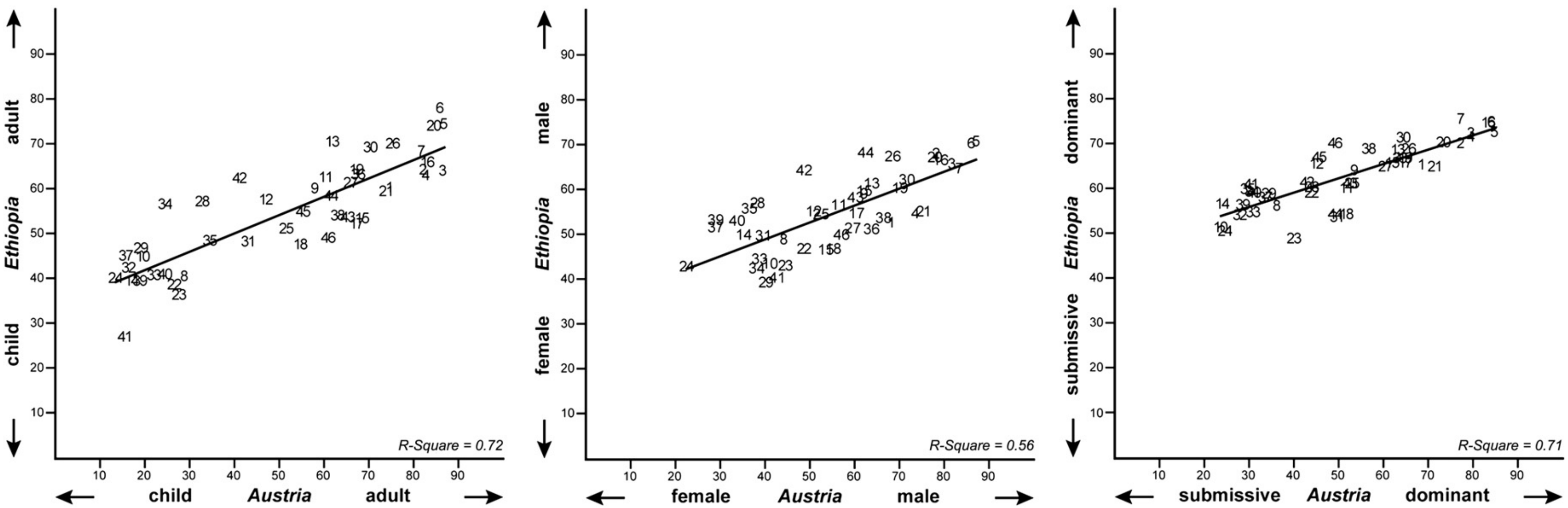

Fig. 2. Intercultural consistency in the attribution of child–adult, female–male and submissive–dominant ratings to car fronts. The three panels show the scatterplots and linear regression lines for the Austrian and the 2009 Ethiopian sample. The regressions were significant at the .001 level, as were the correlations (see main text). The numbers label the single car fronts, which are listed in Appendix A (n=46). This figure not only shows intercultural consistency, but also hints at the close relation of the three scales, which is illustrated by highly similar relative positions of single cars in all three plots.

the labels in Fig. 2, which identify the single car models, suggest, the intercorrelations between these three dimensions were high.

Within the Austrian sample, every pairwise comparison had a correlation coefficient of more than 0.96. In the 2009 comparative Ethiopian sample, the correlation coefficients ranged from 0.68 (female–male compared to submissive–dominant) to 0.81 (child–adult compared to female–male). All p values were below 2.2×10^{-7}.

The correlation coefficients for the other dimensions were again rather low when the Austrian sample and the Ethiopian sample of 2009 were considered. Basically, all items could be allocated to one of two types. Plotting the Austrian car ratings against the Ethiopians' for each trait separately, one type was characterized by a relatively small circular scatter. We use "neurotic" as an example in Fig. 3. This pattern was also observed for agreeable, conscientious, content, disgusted, extroverted, sad and surprised.

The second type is where the Austrians utilized a much broader range than the Ethiopians. This pattern is illustrated with the item "arrogant" in Fig. 3 (right panel). All cars were rated as rather arrogant in Ethiopia, whereas we found various degrees of attributed arrogance for the same cars in Austria. A similar pattern was identified for afraid, angry, aroused, happy, friendly–hostile and open. The average Ethiopian ratings *across all cars* for these items were 62.5 (arrogant), 45.6 (afraid), 42.5 (angry), 44.5 (aroused), 66.6 (happy), 36.4 (friendly–hostile) and 65.6 (open) for the items of this second type of low correlation.

Possible intervening variables such as familiarity with questionnaires (which was investigated in the follow-up questionnaire) and the use of a paper-and-pencil version failed to explain these cross-cultural differences.

3.2. The association of trait attribution and car shape

Shape regressions were calculated to investigate the relationship of the shape of a car front and its constituent parts (headlights, windshield, etc.) with the three scales that showed the greatest cross-cultural consistency: attributed maturity, sex and dominance. For the assessment of shape–trait correspondence and for reasons of clarity, we used the Ethiopian ratings of 2009 and the Austrian data. In all six shape regressions (three items by two countries), none of the 1000 permutations achieved a better (lower Goodall F values) result than the real data (thus, p<.001) in each case. To optimize the depiction of the overall shape pattern that corresponded to different trait attributions, we deformed the average car to ±2 standard deviations (S.D.) of the appearance variable for the Austrian ratings and to ±2.5 S.D. of the Ethiopian scores of the 2009 sample. As the deformations of the average car towards an estimated car that would be rated as child, female or submissive are hardly visually distinguishable from each other and between the two countries, we describe this common pattern of shape change all at once. With regard to global differences, we found a vertical stretching in cars of low attributed maturity and dominance, but high femininity (Figs. 4–6 on the left)

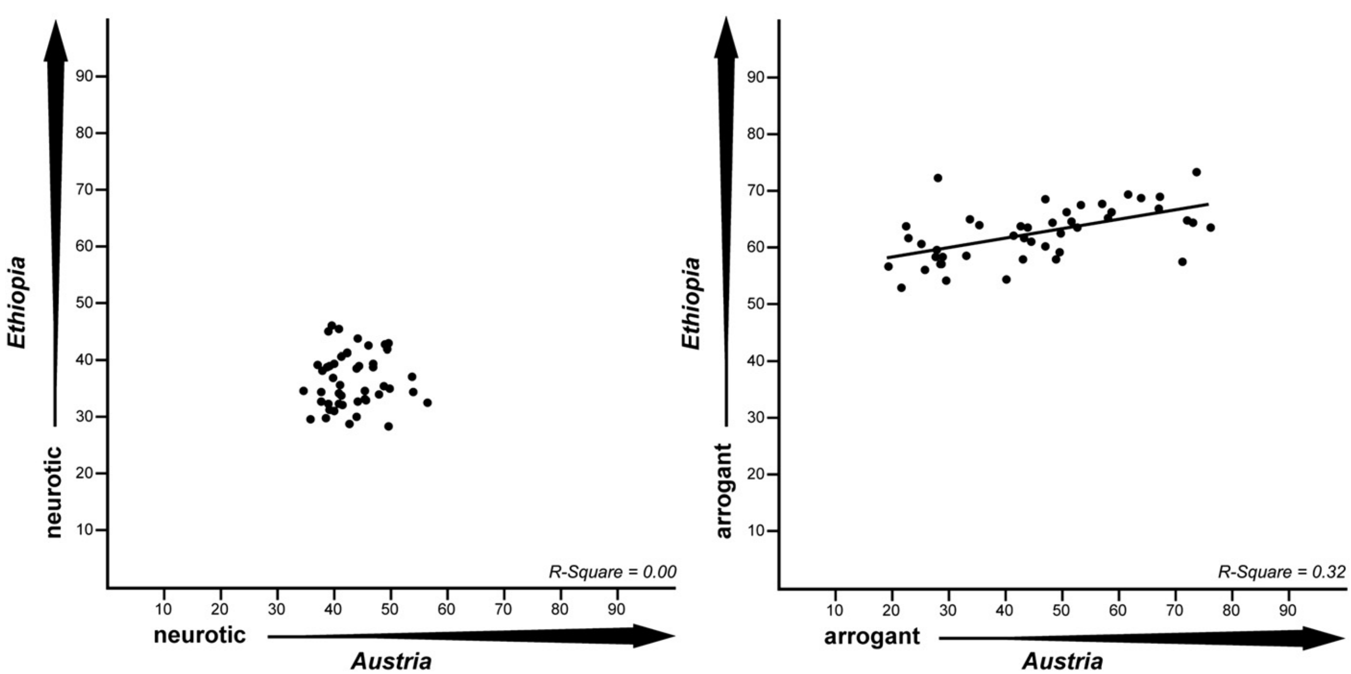

Fig. 3. Two phenomena of low correlation coefficients. Some variables were characterized by a low range of the averaged ratings in both countries and a circular scatter; i.e., all 46 cars were rated similarly along these specific scales (exemplified with "neurotic" in the left panel). The unipolar scales are read from zero (*not at all*) to 100 (*a lot/very much*). The second category was described by an elliptical scatter.

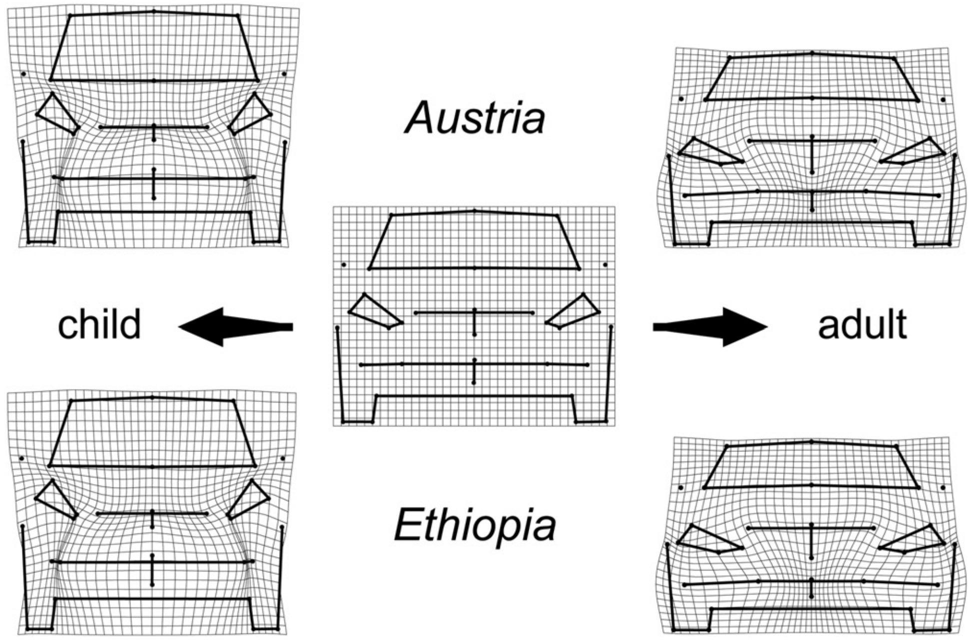

Fig. 4. The shapes of car fronts that were rated as "child" and "adult" in Austria and Ethiopia. The upper panels visualize the shape regressions onto the Austrian perception data; the lower ones, those upon the Ethiopian 2009 attributions on the child–adult scale (n=46 car fronts). The undeformed grid with quadratic squares in the middle in this and the next two figures corresponds to the average car shape of the sample. The configurations and deformation grids depict a highly similar pattern for both countries and correspond to ±2 S.D. for the Austrian and ±2.5 S.D. for the Ethiopian sample from the estimate of the average car.

as opposed to a general compression in cars of high maturity, masculinity and dominance (Figs. 4–6 on the right) in both countries. Concerning local features, the grids show a deformation towards a relatively larger windshield in the direction of low maturity, high femininity and low dominance. Cars that led to associations of adultness, maleness and dominance were characterized by a relatively smaller windshield. As we standardized size during

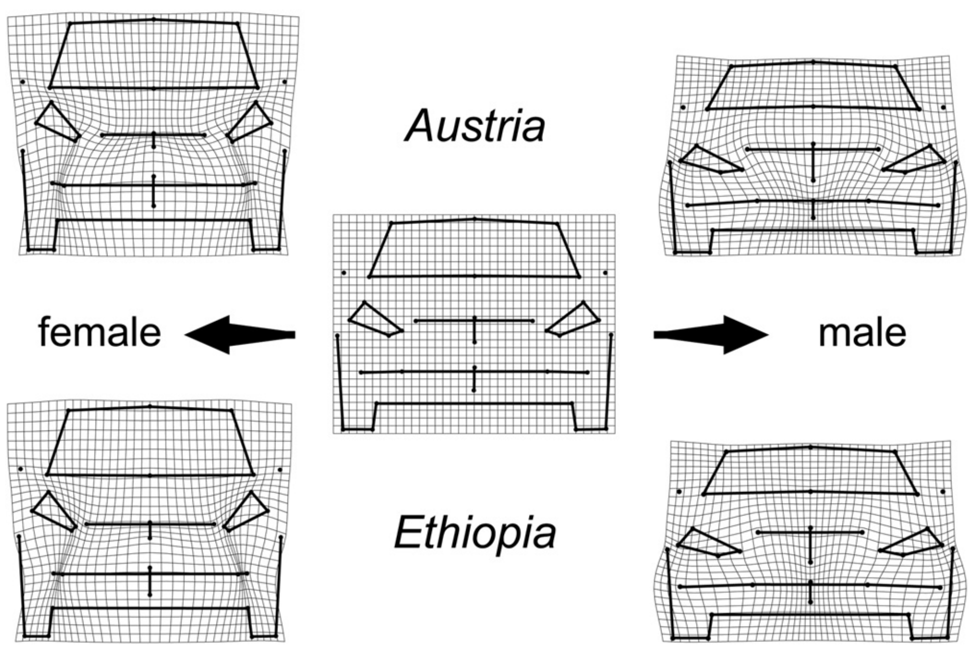

Fig. 5. Estimated car shapes for increased femininity and masculinity attributions in Austria and Ethiopia. The geometry of the average car was deformed in the directions of increased perceived femininity (on the left) and increased masculinity (on the right) for both Austrian ratings (upper panels) and Ethiopian ratings of 2009 (lower panels). The major shape changes were in the relative height-to-width ratio of the car, the relative size of the windshield, the shape of the headlights, the height of the grille and the width of the additional air-intake slots.

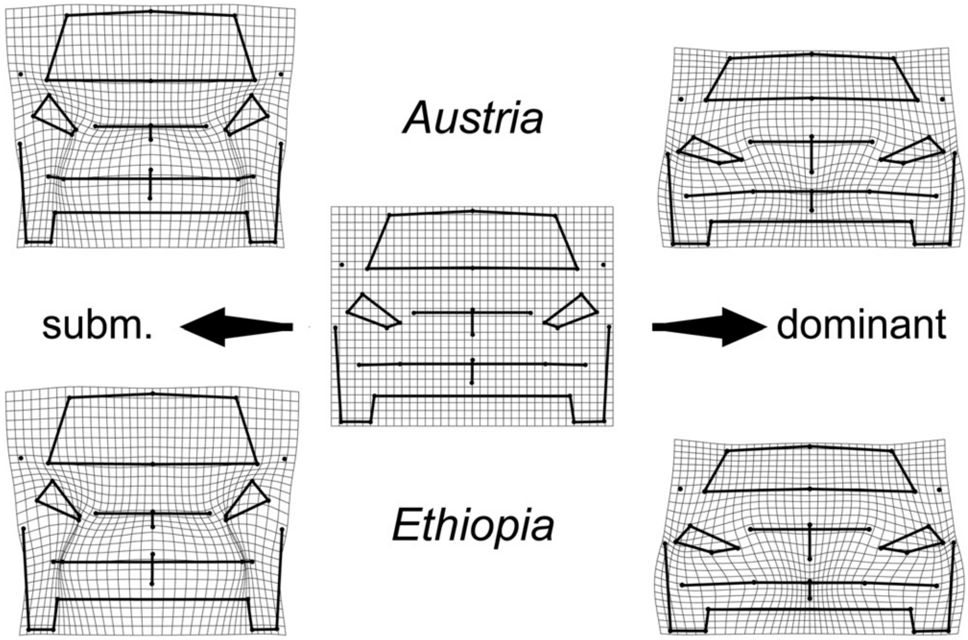

Fig. 6. Visualization of shape regression onto the submissive–dominant scale. The left panels show the predicted shapes for car fronts that are perceived as submissive (abbreviated subm.) in Austria and Ethiopia. The right ones are the estimates that would elicit a dominant impression (n=46 cars). The upper panels are based on the Austrian ratings; the lower ones, on the Ethiopian judgments of 2009. The car in the middle is the shape of the average car in the study and served as the template for the thin-plate spline deformation grids.

Procrustes superimposition, we can only talk about relative differences here. The grille becomes relatively wider and taller with increasing attributed age, maleness and dominance. Also, the headlights differed in shape. The extreme upper and lower edges of the headlights were close to the middle of the car in a vehicle that was likely to be rated as childlike, feminine and submissive, whereas the headlights were extended laterally and were more slit-like in the estimated geometry of a vehicle with an adult, male, dominant appearance. The additional air-intake became wider and thinner with increasing attributed maturity, masculinity and dominance. To repeat, the pattern looked the same for Austrian and Ethiopian ratings (cf. upper and lower panels in Figs. 4–6).

4. Discussion

Our approach of combining rating studies with geometric morphometrics did not make any a priori psychological assumptions on the similarity of faces (or bodies) and car fronts. Actually, the results of the analyses (i.e., the thin-plate spline deformation grids) could have associated any shape change with the car ratings. Our findings — local (e.g., angled vs. round headlights, relatively smaller vs. taller and larger grille, narrow vs. wide additional air-intake) and global (e.g., proportion of windshield to the rest of the car body) shape differences according with changing impressions from child to adult, female to male and submissive to dominant — unearthed the striking similarities between car and face perception. There is much anecdotal evidence on the parallelism of car fronts and (human) faces, yet whether car fronts actually activate brain circuits for face processing or whether our findings stem from a different kind of generalization such as the (rational) judgment of proportions will have to be the subject of follow-up studies.

The current study replicated the pattern of trait attribution to car fronts from Windhager and colleagues (2008) with another Austrian sample of people in their twenties. Furthermore, and more importantly, we added a cross-cultural perspective by collecting data in regions of Ethiopia, where the car models and brands were unknown and car marketing does not exist. There, street transportation is dominated by small trucks, off-road vehicles, some taxi buses, horses and carts, donkeys and people carrying their goods.

4.1. Cross-cultural similarities: inference of allometry

Even though street scenery could not be more different, we found a high cross-cultural consistency in child–adult, female–male and submissive–dominant attributions to cars, with correlation coefficients of 0.75 to 0.85. Thus, these two peoples may have drawn on a common psychological mechanism. As there is hardly any no car marketing in Ethiopia, our results likely are due to the properties of the car. The estimated shape patterns, which hardly vary at all (Figs. 4–6), reflect one underlying dimension of facial proportion. We cannot completely rule out carryover effects from the order of items, but we tried to minimize them by counterbalancing the sex stereotypes in the directions of our rating scales. Moreover, friendly–hostile as the third scale on the questionnaire (between male–female and submissive–dominant) did not reflect the observed patterns for the other three items. Therefore, we believe the biomorphic aspects of the stimuli to be a likelier explanation of our results than potential carryover effects. The most likely candidate for this single dimension is allometry (i.e., the change of facial shape along with proportions during growth) and the corresponding social cues we reviewed briefly in the introduction. A relatively large forehead compared to a short lower face and large eyes leads to increased babyishness attributions and perceived need for protective aid in humans (Alley, 1981; Alley, 1983). The attribution of femininity to the same morphological features might relate to the extended growth period in men (Schaefer et al., 2004; Weston et al., 2007). Along the same lines, rating studies generally confirm the positive association of perceived masculinity, dominance and age in human faces (e.g., Boothroyd et al., 2005; Hess, Adams, Grammer, & Kleck, 2009; Perrett et al., 1998). The observed pattern of overgeneralization to car fronts in this study adds support to the notion that these traits are a single biological dimension of inference from facial form. Of course, we cannot say how often this percept would arise unevoked.

Our study supersedes the findings of Pittenger et al. (1979) by using Cartesian coordinate landmark data instead of a model of proportional gradients referring to just a center and an outline curve that does not allow the detection of regional effects (e.g., headlight shape). Even though our figures and the overall proportions of windshield-to-car body might look similar to those presented by Pittenger et al., the geometry of the child–adult gradient that we found is, in fact, different: their geometry was cardioidal, but ours turned out to be axial.

4.2. Another kind of cross-cultural agreement

We also observed a second, completely different category of cross-cultural agreement: low rating variance in cars around the middle of certain scales (illustrated on the left in Fig. 3). A possible source for this phenomenon is a lack of signal value of these traits in more abstract representations such as cars, and consequently low interrater agreement within each culture. Many studies have shown that some of these traits are hard to judge even in humans (e.g., for neuroticism: Borkenau & Liebler, 1992; disgust: Hess & Blairy, 2001) or seem to correlate with other qualities that our silver cars do not have, such as extroversion being related to attractiveness and conscientiousness to dress style (Albright, Kenny, & Malloy, 1988). Our earlier study (Windhager et al., 2008) also found low interrater agreement for perceived conscientiousness, disgust, extroversion, neuroticism and sadness in car fronts.

4.3. Cross-cultural differences in trait attribution to car fronts

There were differences between Austrian and Ethiopian ratings in items that deal with (emotional) valence (with the exception of openness). There was high differentiation between cars in the Austrian mean ratings, while in Ethiopia, all cars were judged as rather “arrogant” (perhaps in a positive sense), “happy”, “friendly” and “open”. One possible reason is that Ethiopians are very polite and rather restrained in sharing their personal opinion of somebody, especially if it is negative. A second reason might be that interactions with real cars in Ethiopia are generally only positive (transport of water, animals, goods, etc.). Or, third, the more elaborated introduction to the rating task in 2009 still did not overcome the tendency to judge cars in general instead of particular car models (that all cars were judged as “arrogant” in Ethiopia, Fig. 3, favors this conclusion). Fourth, these traits may not be readily perceived in cars but need the emphasis of marketing strategies. To a few Ethiopian subjects, all the cars looked alike, a phenomenon similar to other-race and other-age effects with regard to human faces and their modulation by experience (e.g., Kuefner, Macchi Cassia, Picozzi, & Bricolo, 2008).

For “afraid”, “angry” and “aroused”, the mean ratings ranged around the middle of the scale, perhaps owing to low agreement between the participants. Also, Ethiopian subjects in general tended to use simple subdivisions of the scale (half, one third, two thirds).

4.4. Prospects for future research

The more detailed introduction and explanation of the rating scale in 2009 extended cross-cultural agreement from just child–adult to include male–female and submissive–dominant. The availability of an Oromo translation might also have contributed to this development.

Cross-cultural comparisons would further benefit from an extension of methodologies to assess different levels of perception and cognition. It would help to repeat the eye tracking study of Windhager and colleagues (2010) with an Ethiopian sample and to further investigate the preconscious processing of car fronts by electroencephalography or functional magnetic resonance imaging (cf. Erk, Spitzer, Wunderlich, Galley, & Walter, 2002). Also, the addition of data from more countries and cultures (Henrich, Heine, & Norenzayan, 2010) would certainly help to distinguish between human universals and effects of marketing or advertisement.

The similarities of car and face perception described here might influence driving, pedestrian behavior and the design of car fronts. Do we change lanes sooner when an adult, dominant car appears in the rear-view mirror? Do children perceive cars as agents with eyes (headlights) and therefore assume they see them anyway when they try to cross the street?

4.5. Conclusions

Investigating the relationship between car front shape and personal trait attribution, we obtained very similar results in two different countries, Austria and Ethiopia, on child–adult, female–male and submissive–dominant scales. This finding cannot be interpreted as a result of marketing, brand or owner stereotypes. It likely reflects the perception and interpretation of proportions that shift between child and adult. Car fronts today might address evolutionary mechanisms originally designed for the perception of faces. There are implications of a bias for driving and pedestrian behavior, and for the automotive industry.

We end with the anecdote that inspired the title of this article. Our very first Ethiopian participant in 2008, completing the questionnaire on the side of a dusty road amidst cattle led to the river for drinking, commented on a question as to whether he generally associates a human face, an animal face or no face with cars: “I do not know what to answer. Cars have their own faces!”

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Appendix A

List of the car models under study.
The numbers correspond to the data labels in Fig. 2.

1. Alfa 147
2. Audi A6
3. BMW 3
4. BMW 5
5. BMW 645ci
6. Chrysler 300C
7. Chrysler Crossfire
8. Citroen C2
9. Citroen C4
10. Daihatsu Cuore
11. Fiat Stilo
12. Ford Focus
13. Honda Civic
14. Kia Picanto
15. Lexus GS
16. Maybach
17. Mazda 6
18. Mercedes A
19. Mercedes C
20. Mercedes E
21. Mercedes SLK
22. Mini Cooper
23. Mitsubishi Colt
24. Nissan New Micra
25. Opel Astra
26. Opel Signum
27. Peugeot 307
28. Peugeot 1007 Rc
29. Renault Modus
30. Saab 9-5
31. Seat Toledo
32. Smart Passion
33. Suzuki Swift
34. Toyota Prius
35. Toyota Yaris
36. VW Golf
37. VW New Beetle
38. VW Passat
39. Citroen C1
40. Peugeot 107
41. Toyota Aygo
42. Ford Galaxy
43. Seat Alhambra
44. VW Sharan
45. VW Touran 2005
46. VW Touran 2007

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