Psicológica (2016), 37, 169-185.

Evaluating young and old faces on social dimensions: Trustworthiness and dominance

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In the present study we provide measures of dominance and trustworthiness of a subset of faces from the Productive Aging Laboratory (PAL) Face Database (Minear & Park, 2004). Recent research has shown that dominance and trustworthiness are central to social perception, and that they can be inferred from faces in milliseconds (Oosterhof & Todorov, 2008). A total of 286 faces from four age groups (18-29; 30-49; 50-69; 70-94) were presented and evaluated in dominance and trustworthiness. The same faces were also evaluated on other four dimensions: likeability, perceived age, attractiveness, and gender typicality. This information enriches the PAL Face Database, making it more valuable for researchers investigating face-processing mechanisms across the lifespan. The collected norms are available for download as supplemental materials.

Our faces say a lot about who we are. Faces transmit information about important social categories including age, gender, and ethnicity (Mason, Cloutier, & Macrae, 2006). Faces are also the main vehicle to express emotions and intentions (Horstmann, 2003). The crucial role of faces on our social environment has inspired a large body of research on the topic, such as research on face recognition mechanisms (Bruce & Young, 1986), facial emotions (Russell, 1994), memory for faces (Meissner & Brigham, 2001), and stereotype activation (Blair, Judd, Sadler, & Jenkins, 2002; Ito, Thompson, & Cacioppo, 2004). Previous research has suggested that faces involve a configural type of processing that is not involved in the

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processing of objects (Richler, Cheung, & Gauthier, 2011; Tanaka & Farah, 1993; Young, Hellawell, & Hay, 1987). Also, research suggests that there are specialized areas of the brain dedicated to face processing (Dekowska, Kuniecki, & Jaśkowski, 2008; Grill-Spector, Knouf, & Kanwisher, 2004; Kanwisher & Yovel, 2006; Pitcher, Walsh, & Duchaine, 2011). Specifically, there are three brain regions that tend to be associated with the processing of faces: one region in the superior temporal sulcus (fSTS), one region in the lateral occipital cortex ("occipital face area" – OFA), and an area located in the fusiform gyrus, called the "fusiform face area" (FFA). From these three regions, the FFA is the one that more consistently responds to faces, compared with objects (Grill-Spector, Knouf, & Kanwisher, 2004; Kanwisher, McDermott, & Chun, 1997).

An important finding of the research on face processing is that people quickly extract information about other people's traits from their faces (for a review see Todorov, 2012). For example, it has been shown that even brief exposures to faces (50-100 ms) are sufficient for participants to make trait inferences from unknown faces that are highly correlated with inferences made without any time constraints (Todorov, Pakrashi, & Oosterhof, 2009; Willis & Todorov, 2006). These results suggest that inferring traits from faces is a highly automated process.

People infer traits from facial appearance very quickly, but what kinds of traits are inferred? According to Oosterhof and Todorov (2008), people evaluate faces in terms of two fundamental dimensions: trustworthiness and dominance. The authors applied a principal component analysis to trait judgments made from neutral faces and found that these two orthogonal dimensions accounted for most of the variance in the evaluations. The trustworthiness dimension represents essentially a valence dimension, with traits such as attractiveness and responsibility loading heavily on its component. On the other hand, the dominance dimension captures judgments of dominance, aggressiveness and threat, corresponding to a broad dimension of power.

Trustworthiness and dominance are similar to other basic dimensions of social perception, such as the social and intellectual dimensions (Rosenberg, Nelson, & Vivekananthan, 1968); warmth and competence (Fiske, Cuddy, & Glick, 2007), morality and competence (Wojciszke, 2005; Wojciszke, Bazinska, & Jaworski, 1998), nurturance and dominance (Wiggins & Trapnell, 1996), or communion and agency (Wiggins, 1991). In all, whether their names may differ by various authors, two similar and general dimensions that are central in social perception tend to be reliably found across different laboratories. These two dimensions are likely to have

an important adaptive value. While the trustworthiness dimension provides relevant information about other's intentions to cause us harm or good, the dominance dimension provides us information about other's ability to act upon such intentions. Thus, evaluating trustworthiness and dominance seem to have an evolutionary value, allowing our ancestors to quickly differentiate potential enemies from allies.

Given that trustworthiness and dominance judgments can be grasped very quickly from people's faces, and that they have the power to influence impressions at a very early stage (Todorov et al., 2009), it becomes important that the database of faces applied in research contains standardized information about the ratings of each face in terms of these two central dimensions, so that researchers can explicitly control or manipulate their influence. The current study aims to expand the data of the PAL database (Minear & Park, 2004) by providing ratings of trustworthiness and dominance on a selected subset of faces.

These norms are particularly useful for person perception studies, but can also be useful in other domains of research in which photographs of faces have been broadly applied, for example in studies of attention (e.g., Downing, 2000; Ramos, Garcia-Marques, Santos, & Carneiro, 2015; Tipper, Grison, & Kessler, 2003), and memory (e.g., Depue, Banich, & Curran, 2006; Grady et al., 1995; Jones, Bartlett, Wade, 2006; Perfect et al., 2004). Such norms might be of particular interest to studies that include ratings in these dimensions as independent or dependent variables (e.g., trustworthiness; Bayliss & Tipper, 2006; Fenske & Raymond, 2006).

The PAL Database of Adult Faces

Minear and Park (2004) created a database that includes a large number of photographs of adult faces (576 individuals), in color and in black-and-white, belonging to different age groups ranging from 18 to 93 years old – the Productive Aging Laboratory (PAL) Face Database. The database can be downloaded from https://pal.utdallas.edu/facedb/. Recently, Ebner (2008) enriched the database by providing ratings of a subset of 160 faces in terms of different dimensions: attractiveness, likeability, distinctiveness, goal orientation, energy, mood and age. The PAL face database is an important tool for researchers. Contrary to the majority of available databases, the PAL database contains faces of people of different age groups, with a substantial number of faces belonging to people over 50 years old (281 individuals). In addition, although the majority of faces are Caucasian, other races are also fairly represented in the database (16% are

African-American faces and 8% are Asian, South Asian, and Hispanic faces).

The fact that the PAL database includes faces of other age groups is quite pertinent. In general, research on face processing applies faces of young people as stimuli. However, the age of the stimuli faces may influence the type of operating cognitive processes. Young faces differ from older faces in several aspects (Lanitis, Taylor, & Cootes, 2002; Ramanathan & Chellappa, 2006), such as that age influences the facial aesthetics of a person, indicating that results obtained in studies using young faces as stimuli might not be found when older faces are presented. The inclusion of older faces in studies might be particularly crucial given recent findings showing that face perception might be better captured by adding a third "youthful-attractiveness" dimension (Sutherland et al., 2013).

Present Study

Our goal is to extend the PAL database of faces by providing ratings of trustworthiness and dominance - two fundamental dimensions of social perception - for a subset of 286 faces from the database. However, we also included ratings of 4 other dimensions of the faces: attractiveness, likeability, gender typicality, and perceived age. *Attractiveness* was included because it is a central dimension in face perception linked to halo effects (Eagly, Ashmore, Makhijani, & Longo, 1991; Langlois et al., 2000). *Likeability* was incorporated as a generic measure of valence. This is a common measure in several studies (e.g., Krendl et al., 2006; Rule & Ambady, 2008), for example, in studies that explore mere exposure effects (Rhodes, Halberstadt, & Brajkovich, 2001; Zebrowitz, White, & Wieneke, 2009). *Gender typicality* provides an indication of the degree to which each face is considered representative of his or her gender category (i.e., male or female), a dimension especially useful in studies that explore perception of gender information (e.g., Campanella, Chrysochoos, & Bruyer, 2010). Finally, *perceived age* validates the inclusion of a specific face in its category, since real and perceived age can differ substantially (see Voelkle, Ebner, Lindenberger, & Riediger, 2012). Note that, although Ebner (2008) has covered some of these measures (attractiveness, likeability, and age), the faces selected in our study do not correspond exactly to the ones selected by Ebner (see Appendix B).

METHOD

Participants. Two-hundred and thirty-two psychology undergraduate students (48 males, 184 females, mean age = 22.02 years, SD = 6.9, age range = 18 to 56) from the Department of Psychology at the University of Lisbon participated voluntarily in this study for course credit. 209 participants (90.1%) were in the 18-29 years old age group, 21 participants (9.1%) were in the 30-49 years old age group, and only 2 participants were in the 50-69 years old age group (0.9%).

Materials. All facial stimuli used in this study were selected from the PAL Face Database. All faces showed a neutral expression and displayed individuals in a full frontal view. Images were resized to 320 X 240 pixels. We selected 286 grey-scale photographs of male and female faces. The criteria for selection were the following. First, we chose faces from the four different age groups. Second, we selected faces that looked most similar with the Portuguese population. As such, most of the selected faces are Caucasian, with only a small number of faces belonging to different races (3.4%).

Selected faces included: (a) 63 female faces between 18-29 years, (b) 70 male faces between 18-29 years, (c) 33 female faces between 30-49 years, (d) 24 male faces between 30-49 years, (e) 24 female faces between 50-69 years, (f) 24 male faces between 50-69 years, (g) 24 female faces between 70-94 years, and (h) 24 male faces between 70-94 years. As in the original database, the number of faces in the two younger groups was larger than the number of faces in the two older groups.

In order to assure that the length of the session was not too long, and given the approximate number of available participants, four different versions of the material were created: Version A included the 192 faces from the two younger age groups (18-29 and 30-49 years) and prompted ratings of attractiveness, dominance and trustworthiness; Version B included the same 192 faces as version A but included ratings of gender typicality, likeability, and age estimation; Version C included the 96 faces from the two older age groups (50-69 and 70-94 years), with ratings of attractiveness, dominance and trustworthiness; and Version D included the same 96 faces as version C with ratings of gender typicality, likeability and age estimation. The number of participants that saw each set of faces was

the following: Version A (64 participants), Version B (56 participants), Version C (55 participants), and Version D (57 participants)[1].

Even though the division of the scales by versions was made in a somewhat random way, our criterion was to place trustworthiness and likeability in different versions since both capture valence, and can thus be correlated. Also, we placed gender typicality and dominance in different versions as they may also be correlated (see Oosterhof & Todorov, 2008). We did not include new and old faces in the same version to achieve a greater differentiation amongst evaluations. If the faces had been mixed, judgments could have been more similar within-categories and more dissimilar between-categories.

Procedure. The task was administered using the E-Prime software (Psychology Software Tools, PA, Schneider, Eschman, & Zuccolotto, 2002). The study was conducted in a laboratory room set-up with ten separated computer terminals. Groups of five to ten participants were tested in each experimental session, but each participant worked individually on a computer. Participants were randomly assigned to one of four versions of the material. Participants were instructed that they would see several faces and that their task would consist in evaluating each face in three different dimensions. Instructions emphasized that all judgments about the target faces should be fast and spontaneous. During the task, each screen exhibited one photograph in its center with a nine-point scale below. The task was self-paced, with the photograph and the scale remaining on the screen until a response was given. Participants provided their responses via the numerical keys on the keyboard. After each round of three ratings for each photograph, a fixation point ("+++") was displayed on the center of the screen for 150 ms before the onset of the next photograph. The order of facial stimuli was randomized for each participant.

Versions A and C. For the participants assigned to the A and C versions, instructions stated that their task was to rate each face in three different dimensions, using a nine-point scale ranging from 1 – "Not at all [dimension]" to 9 - "Very [dimension]". We used a 9-point scale to allow

[1] Due to a miscommunication between the experimenters we ended up with a slightly higher number of participants in Version A. We decided to not throw away data only to perfectly balance the sample sizes. However, it is unlikely that the difference in sample sizes drastically affects the results.

for a finer discrimination between ratings of the different faces[2]. In an attempt to minimize interpretative subjectivity, the instructions included a brief description for each of the three rating dimensions: dominance, trustworthiness and attractiveness. For the dominance ratings, participants were asked to indicate whether "the person appears to have a more submissive or a more dominant face", (1 = "submissive" and 9 = "dominant"). The trustworthiness description asked participants to indicate, "how trustworthy or untrustworthy does the person appears to be" (1 = "not trustworthy at all" and 9 = "very trustworthy"). Finally, the attractiveness description asked the participants to indicate, "how attractive do you find the person to be" (1 = "not attractive at all" and 9 = "very attractive"). Each photograph remained static in the center of the screen until all three dimensions were rated. The order of exposure to the three dimensions was counterbalanced across participants, such that each dimension had an equal likelihood of being rated in the first, second, or third position.

Versions B and D. Participants assigned to this condition engaged in two tasks: a rating task and an age estimation task. Task order was counterbalanced between subjects. The rating task was similar to the one from condition A in every way, with the exception that only two dimensions were rated per photograph this time, namely: gender typicality and likeability (the order of the two scales was also counterbalanced between subjects). The description about the gender typicality ratings informed the participants that "independently of gender, faces can exhibit more masculine or more feminine features", and were then asked to indicate "to what extent does each face appear to incorporate more masculine or more feminine features (1 = "very feminine" and 9 = "very masculine"). For the likeability ratings, participants were asked to indicate, "how likeable or unlikeable each person appears to be" (1 = "not likeable at all" and 9 = "very likable"). After finishing rating all the facial stimuli, participants either switched to the age estimation task or finished the session, depending on which task order sub-condition they had been assigned to. In the age estimation task, participants were instructed that they would visualize several faces and that their task was to estimate the age of each face. In each trial during the task, a photograph was exhibited in the center of the screen with the following question above it: "How old do you think this person is?" Responses were provided via the numerical keys on the keyboard,

[2] A scale should be as finer as the participant's ability to discriminate between the different data points. Given people's proficiency in judging faces, a scale with more data points seemed as an appropriate choice. On the other hand, scales with more than 10 points seem to have poorer psychometric properties (e.g., Preston & Colman, 2000).

followed by ENTER for confirmation before advancing to the next photograph. After concluding this task, participants either advanced to the rating task or completed the session, depending on which task order sub-condition they had been assigned to.

After completing the task, all participants were thanked and debriefed.

RESULTS AND DISCUSSION

Ratings of Faces. The average ratings and standard deviations of the 286 faces in the 6 evaluated dimensions are presented in Appendix A. In order to facilitate the comparison of results with previous studies, the original codes of each face are listed (Minear & Park, 2004), as well as the codes used in the present study. Examples of faces rated high and low in trustworthiness and dominance are shown in Figures 1 and 2. It is worth mentioning that, on average, faces received low attractiveness ratings, a result that is in line with the data reported by Ebner (2008).

In order to compute perceived age estimates (Appendix A and B), we excluded estimates higher than 100 years old and lower than 15 years old (only 0.2% of the responses were excluded using this criterion). In many cases the mean perceived age did not fall within the corresponding age group interval. This happened for 23 female faces in the 18-29 age group (35.5%), 22 male faces in the 18-29 age group (30.5%), 7 female faces in the 30-49 age group (21.2%), 8 male faces in the 30-49 age group (33.3%), 1 female face in the 50-69 age group (4.2%), 2 male faces in the 50-69 age group (8.3%), 12 female faces in the 70-94 age group (50%), and 11 male faces in the 70-94 age group (45.8%). While for the three younger groups the differences between perceived age and estimated age were always due to an overestimation of age, in the older group differences were the result of an underestimation of the age.

Existing differences between perceived and real age confirm the importance of including measures of subjective age in life span databases of faces. More importantly, the present results extend those by Ebner (2008) in which participants were asked to estimate the face's age within an interval, whereas we asked for a specific numerical estimation. In order to facilitate a comparison between age estimations in the two studies, we included information about the interval in which each one of the faces was judged in Ebner's study (Appendix B). From the total number of faces used in our study, 120 were also used by Ebner. In most cases (85%), the mean age estimated falls within the interval in which the face was most frequently included in Ebner's study. In a minority of cases (15%) the mean age

estimated falls within the second interval in which the same face was most frequently included in Ebner's study. This reveals a high consistency among age estimations between the two studies.

Figure 1. Examples of faces perceived as high and low in trustworthiness in the 18-29 age group. Ratings on a scale ranging from 1 (untrustworthy) to 9 (trustworthy). Image source: http://agingmind.utdallas.edu/facedb. *Authors granted permission to use their images.

Table 1 presents the descriptive information about the ratings of faces, as function of age and gender. These data suggest some differences in ratings as a function of age and gender groups. For instance, gender

differences between trustworthiness ratings seem to disappear in the older age group, which suggests that although facial cues to trust tend to be more associated with female faces, they become more indistinguishable as faces get older. However, given the design of our study, these data serve descriptive purposes only and are merely suggestive for inferential purposes.

Figure 2. Examples of faces perceived as high and low in dominance in the 18-29 age group. Ratings on a scale ranging from 1 (submissive) to 9 (dominant). Image source: http://agingmind.utdallas.edu/facedb. *Authors granted permission to use their images.

Table 1. Descriptive statistics as function of age and gender.

		Trustworthiness		Dominance		Attractiveness		Likeability		Gender typicality	
		n	*M(SD)*	*n*	*M(SD)*	*n*	*M(SD)*	*n*	*M(SD)*	*n*	*M(SD)*
Age Group	Gender										
18-29	Female	64	5.01(1.06)	64	4.74(0.77)	64	3.69(1.12)	56	4.72(0.90)	56	5.46(0.95)
	Male	64	4.16 (1.10)	64	5.54(0.78)	64	2.90(1.11)	56	4.28(1.15)	56	7.13(0.96)
30-49	Female	64	4.83(1.12)	64	4.77(0.86)	64	2.88(1.03)	56	4.22(1.05)	56	5.10(0.95)
	Male	64	4.00(1.19)	64	5.91(0.94)	64	2.38(1.04)	56	4.11(1.23)	56	7.48(0.84)
50-69	Female	55	4.59(1.25)	55	4.95(1.03)	55	2.93(1.52)	57	4.66(1.24)	57	5.24(1.08)
	Male	55	4.21(1.33)	55	5.80(1.09)	55	2.65(1.40)	57	4.54(1.16)	57	7.22(0.89)
70-94	Female	55	4.99(1.33)	55	4.43(1.09)	55	2.78(1.40)	57	4.72(1.22)	57	5.25(0.99)
	Male	55	4.96(1.38)	55	5.14(1.06)	55	2.77(1.50)	57	4.97(1.20)	57	7.16(0.91)

Correlations. Table 2 shows the Pearson correlations per item between the trustworthiness, dominance and attractiveness ratings. There were significant correlations between evaluations in these scales. Specifically, faces rated high in trustworthiness tended to be judged as more attractive (.59). This is in agreement with the notion that these scales tap a valence dimension. On the other hand, faces judged as trustworthy tended to be evaluated as less dominant, as indicated by a negative correlation between ratings in these two dimensions (- .55) . These correlations did not differ amongst the different face age groups. Note that, although some of the correlations are in line with the ones obtained in the previous literature, given the limited number of faces, we cannot make generalizations or test models of trait inferences (e.g., Oosterhof & Todorov, 2008). Nevertheless, they can be of indicative value.

Table 2. Correlations between attractiveness, trustworthiness, and dominance.

	1	2	3
1. Attractiveness	1.00		
2. Trustworthiness	0.58*	1.00	
3. Dominance	0.02	-0.55*	1.00

Correlations were also computed between gender typicality, likeability and perceived age (Table 3). Perceived age is positively correlated with likeability, suggesting that older faces are perceived as more likeable. Gender typicality is negatively correlated with likeability (-.29). Similar correlations were observed, independently of the face-age group, except in the following case: the negative correlation between gender typicality and likeability was only observed for faces in the young group, and not for faces in the other age groups.

Table 3. Correlations between gender typicality, likeability, and perceived age.

	1	2	3
1. Gender typicality	1.00		
2. Likeability	-0.30*	1.00	
3. Perceived Age	0.02	0.12*	1.00

We also computed the same correlations for male and female participants separately. Most of the correlations were unaffected by the sex of the participants, except in the following cases. The negative correlation between gender typicality and likeability observed for faces in the younger group is not significant when only the responses of the male participants are considered. Thus, for male participants, more masculine faces are not rated as less likeable. In addition, the positive correlation between likeability and perceived age is also not significant for the male subsample.

Conclusion

In the present study, participants were asked to rate a total of 286 faces from four age groups (18-29; 30-49; 50-69; 70-94) from the CAL/PAL Face Database (Minear & Park, 2004) on six dimensions: trustworthiness, dominance, likeability, perceived age, attractiveness, and gender typicality. The purpose of the study was to provide face-specific ratings for this selection of faces varying in age. Therefore, for each face and each rating dimension, ratings across the total sample were reported.

However, the present findings should be carefully interpreted in the light of the “similarity effect” - a bias caused by the similarity between the

participant and the faces presented as stimuli (e.g., Bailenson, Iyengar, Yee, & Collins, 2009; Kuefner, Cassia, Picozzi, & Bricolo, 2008; Platek, Krill, & Wilson, 2009; Wright & Stroud, 2002). Our younger participants might not have discriminated between older facial stimuli as good as the older participants did, albeit in a smaller number. Indeed, one of the limitations of the present research is the disproportional amount of younger participants rating the facial stimuli. Although most ratings did not differ between young and old participants in the study conducted by Ebner (2008), some differences were reported. Specifically, older participants rated the faces as more attractive and energetic, compared with younger participants, which indicates that ratings of younger and older participants might diverge in specific dimensions. A second limitation of the present study is that our sample consisted mostly of female participants. Finally, although we counterbalanced the order of presentation of the different scales, it is still possible that ratings in one dimension might have influenced ratings in the other dimensions. These aspects must be considered when using the present norms.

It is worth noting that the existing differences between perceived and real age confirm the importance of including measures of subjective age in life span databases of faces. The perceived age ratings for faces of the four different age groups were not always adequate and neither did they properly reflect the target age groups. In many cases, the mean perceived age did not fall within the corresponding age group interval. Namely, while for the three younger groups the differences between perceived age and estimated age were always due to an overestimation of age, in the older group differences were the result of an underestimation of the age. These findings do not indicate that the database contains an invalid set of faces in terms of age groups represented in the pictures, but only that perceived age during life span must be considered as an additional variable that might affect ratings on other dimensions.

In sum, the present results build on the PAL face database by providing norms of trustworthiness and dominance for a subset of 286 faces from four different age groups. Trustworthiness and dominance are good measures of the two social dimensions underlying processing of faces (Oosterhof & Todorov, 2008). These dimensions can affect our impressions of other people under brief exposures to faces (Todorov et al., 2009) and even when there is no conscious awareness of the faces stimuli (Todorov & Duchaine, 2008). Recent studies showed that participants are more willing to collaborate and trust in actors with trustworthy-looking faces (Tingley, 2014; van't Wout & Sanfey, 2008). Given their ubiquity and importance in social perception, it seems crucial to be able to control these dimensions.

Recently, Todorov, Olivola, Dotsch, and Mende-Siedlecki (2015) noticed that they did not include faces from different age groups in their studies, which prevented them from drawing conclusions about eventual effects of age on their model. We believe that the presented norms will increase the possibility of exploring face perception processes with faces representing a wide range of different age groups.

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(Manuscript received: 13 October 2015; accepted: 22 February 2016)