What in a Photo Makes you Trust a Person Online? A Structural Equation Modeling Approach

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The use of sellers' personal photos online is ubiquitous in sharing economy platforms such as Airbnb. Scientists have attempted to identify the role of facial characteristics in inferring traits such as trustworthiness by controlling each feature separately or by developing dimensional models based mainly on computer-generated faces. We propose an alternative structural approach that uses a set of naturalistic images. We use a structural equation model (SEM) to examine the complex effects of different facial and image characteristics on the perceived trustworthiness of 320 Airbnb hosts based on their photos. We find that basic facial characteristics such as age, gender, and smile directly affect the perceived trustworthiness and attractiveness of hosts. The use of the structural equation model allows us to differentiate between the direct effects of these characteristics on perceived trustworthiness and the indirect effects that operate via attractiveness. We also show that image characteristics such as photo quality and the inclusion of other people, which are not directly related to the person whose trustworthiness is being assessed, play a significant role in trust inference.

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Facebook strongly encourages the use of personal photos on the internet and such photos are now used extensively in many types of websites and apps. The rapidly growing sharing economy markets (e.g., Airbnb, Uber), in which the need for trust between buyers and sellers is vital, are good examples of virtual spaces in which personal photos are widely used. Recent research on social inference from facial characteristics has shown that people can make instant inferences regarding strangers' character traits (Hellström & Tekle, 1994; Todorov, Olivola, Dotsch, & Mende-Siedlecki, 2015) from exposure to their images. While these inferences are often unwarranted (Todorov & Porter, 2014), they nonetheless play a role in predicting real-world decision making, such as voting decisions (Olivola & Todorov, 2010; Rezlescu, Duchaine, Olivola, & Chater, 2012), and in yielding economic benefits. For example, Ert, Fleischer, and Magen (2016) showed that the more trustworthy hosts in Airbnb are perceived to be in their personal images, the higher the price they can charge for their listings and the higher their listings' probability of being booked.

The current article aims to clarify the determinants of trustworthiness inference from online personal images that people post. The existing literature on character trait inference from facial characteristics has typically focused on computerized frontal headshots (see Todorov et al., 2015 for a comprehensive review). In this study, we use naturally occurring online photos that are not necessarily frontal headshots. They may show the face at different angles and include other parts of the body. Moreover, the use of natural images allows us to evaluate the inference of trustworthiness from image characteristics beyond facial characteristics, for example photo quality and the context in which the person appears in the photo (e.g., individual or group photos). In addition, the use of structural equation modeling (SEM) allows us to identify the direct and indirect effects of the different facial and image characteristics on the perception of

trustworthiness. Accordingly, our research objectives can be phrased as follows: (1) to test whether facial characteristics shape trait inferences when people view naturally occurring photos that include more than a headshot; (2) to test whether inferences might be influenced by image characteristics; and (3) to use SEM to quantify and test for the potential direct and indirect effects of facial and image characteristics on perceived trustworthiness.

The current study is based on recent literature that has shown that people form immediate face-to-trait inferences (regarding, e.g., a person's trustworthiness) in one tenth of a second (Willis & Todorov, 2006) from early childhood (Cogsdill, Todorov, Spelke, & Banaji, 2014). Consequently, recent studies have begun to explore which facial characteristics determine these character trait inferences (Todorov et al., 2015) and the processes through which such inferences might occur (Martin & Macrae, 2007). Some studies have attempted to identify the basic facial characteristics that create social inference by testing for each characteristic separately. Physical facial characteristics found to be effective include attractiveness (Wilson & Eckel, 2006), smiling expression (Krumhuber et al., 2007; Scharlemann, Eckel, Kacelnik, & Wilson, 2001), and gender (Eckel & Wilson, 2003). Other studies have shown that attractiveness is not an independent facial characteristic, but is affected by some of the physical characteristics that affect the inference of trustworthiness, such as smiling expression (Krumhuber et al., 2007) and gender (Tracy & Beall, 2011). However, since these studies tested each facial characteristic individually, they were unable to shed much light on the joint effect of facial characteristics on perceived trustworthiness when considered simultaneously.

The question of the joint effect of facial characteristics has been explored by a different central line of research using a dimensional approach that is more holistic than the approaches used in the aforementioned studies. This approach has suggested models of two or three basic

dimensions of social inference that are mainly based on controlled experiments with computer-generated faces. These elegant dimensional models show that the evaluation of faces can be predicted by their location in (two- or three-) dimensional space. Oosterhof and Todorov (2008), who suggested dominance and trustworthiness as the basic dimensions for face evaluation, initiated this approach. Sutherland et al. (2013) offered an additional dimension for face evaluation – youthfulness-attractiveness. This dimension was motivated by Sutherland et al.'s (2013) finding that attractiveness ratings decrease with age. This finding and the positive correlation between attractiveness and trustworthiness (Todorov et al., 2015) together imply that trustworthiness should also decrease with age, yet Sutherland et al. (2013) found a positive correlation between trustworthiness and age. These findings suggest that facial characteristics might affect trustworthiness both directly and indirectly (e.g., via attractiveness), and these effects are not always in the same direction. We are unaware of any studies that have attempted to separate such potential direct and indirect effects. Thus, one of our objectives in this paper is to disentangle such effects.

The use of natural images allows us not only to complement the existing literature on the role of facial characteristics, but also to test the role of image characteristics in trait inference. We considered three possible image characteristics: a multi-person photo, face prominence (how clearly the face is seen in the photo), and photo quality. We chose to study the multi-person image characteristic in light of the tendency of some individuals to post a photo of themselves with other people as their profile image. Our interest in multi-person characteristics is further motivated by somewhat related findings that indicate that the attractiveness of a group is perceived to be higher than the average attractiveness of its members (Osch, Blanken, Meijs, & Wolferen, 2015; Walker & Vul, 2013). The second image characteristic we examine relates to

the observation that people post photos in which their faces are not prominent or not seen clearly (e.g., the photo might include a large part of the body). The most pertinent study that we could find was conducted by Schwarz and Kurz (1989), who showed that people photographed with a high degree of facial prominence were evaluated as more competent than those with low facial prominence. The third image characteristic we examine is the quality of the photo, since in reality people post images of different levels of quality. The literature that addresses the role of image characteristics on trait inference is sparse and we could not find studies on which to base our hypotheses. We hypothesized that facial characteristics affect the perception of trustworthiness both directly and indirectly via attractiveness. Moreover, since some effects may act in opposite directions, the full impact of these features together on perceived trustworthiness is not trivial. Table 1 presents our hypotheses regarding the direction of the effects of facial and image characteristics on attractiveness and trustworthiness. Based on the previous studies discussed above, we hypothesized that perceived attractiveness would be positively affected by smiling expression and female gender, but negatively affected by age. The effect of the image characteristics on attractiveness is less clear. As we noted above, there is some evidence to suggest that multi-person photos positively affect attractiveness, but we could not find studies that examined the role of photo quality or face clarity. We hypothesized, based on our intuition, that both characteristics would positively affect attractiveness.

The rightmost column of Table 1 presents our hypotheses regarding the effects of facial and image characteristics on trustworthiness. Based on previous studies, we expected that attractiveness would correlate positively with trustworthiness. Furthermore, smiling expression, female gender, and age were also expected to positively affect trustworthiness (see, e.g., Sutherland et al., 2013). The use of SEM enables us to break down each of these effects into its

various components. The most interesting analysis refers to the role of age. Assuming that inference from faces can be generalized to the context of natural photos, age should affect attractiveness and trustworthiness in opposite directions, so the relative strength of each of these associations could shed light on the possible direct and indirect effects of age on perceived trustworthiness.

The effects of image characteristics on perceived trustworthiness are difficult to predict considering the dearth of literature on this subject. There is some evidence that facial clarity might increase trustworthiness, given the effect of face prominence discussed above. We also hypothesized that multi-person photos could signal sociability and photo quality could signal preciseness, and thus both could positively affect perceived trustworthiness.

Method

Ethics statement

The procedure was reviewed and approved by the ethics committee for studies involving human participants at The Hebrew University of Jerusalem. The participants from Amazon's Mechanical Turk gave their informed consent online before beginning the rating task.

Apparatus and Procedure

Participants (N = 640; 246 males; mean age = 36.6 years, range = 19–82) from Amazon's Mechanical Turk rated personal photos of Airbnb hosts, downloaded from Stockholm's Airbnb website (Ert et al., 2016). The photos were presented out of context, i.e., the raters were not aware of their relationship to Airbnb. Each photo was evaluated by 20 participants, and each participant was presented with 10 photos separately and rated the following qualities of each

photo: trustworthiness ("How trustworthy is this person?"; scale 1–10); attractiveness ("How attractive is this person?"; scale 1–10); gender (single male, single female, multi-person[2]); age; smiling expression (yes/no); photo quality (scale 1–10); and whether the person's face is seen clearly (yes/no). Our analysis includes 320 observations, one for each picture, and the variables we used are the mean value for each answer. We did not consider race, since 315 hosts were Caucasians.

Results

The trustworthiness and attractiveness ratings were each averaged across raters for every personal photo. Inter-rater correlation analyses were performed on the rating data for the photos in each group of participants. Results indicated adequate levels of reliability (trustworthiness, average score = .796; attractiveness, average score = .809). Means, standard deviations, and zero-order correlations of the key variables are presented in Table 2.

We applied the SEM to the Airbnb hosts' personal photos. Specifically, we tested the impact of each of the basic facial and image characteristics on perceived attractiveness and trustworthiness and the impact of attractiveness on trustworthiness. The use of SEM allowed us to distinguish between the direct and indirect effects of the facial and image characteristics and reveal the role of attractiveness as a mediator. We decided to estimate a saturated model in order to test all possible links between the facial and image characteristics and trustworthiness. We were able to estimate both the direct effects of these characteristics on perceived trustworthiness and their indirect effects on trustworthiness via attractiveness. We used maximum likelihood

[2] The vast majority of the multi-person photos were of heterosexual couples.

method in STATA 14. The estimation results of the SEM analysis appear in Table 3 and Figure 1.

The results reveal that the attractiveness-trustworthiness correlation is positive, as expected (the coefficient of attractiveness in the trustworthiness equation is 0.3). Smiling expression was found to have a positive and significant effect on both attractiveness and trustworthiness. Yet, interestingly, its full effect on trustworthiness is mainly direct (86%) rather than via attractiveness. We also found that women are perceived as more trustworthy than men, and that 51% of this effect occurs indirectly via attractiveness, as women are also perceived as more attractive than men. The total effect of a female image on trustworthiness is 0.45. About half of it is a direct effect and the other half is mediated via attractiveness. The results also confirm our expectations regarding the effects of age on perceived attractiveness and trustworthiness. We found a negative effect of age on perceived attractiveness; each additional year reduces the attractiveness rating by 0.07 points. This means, for example, that a forty-year-old person is perceived to be less attractive than a twenty-year-old by 1.4 points, all other things being equal. On the other hand, our examination of the *direct effect* of age on trustworthiness reveals a positive effect; each year adds 0.03 points to the trustworthiness score. Consequently, the overall effect of age on perceived trustworthiness is *positive*, although due to the opposing directions of the direct and indirect effects, the total effect of age on trustworthiness is much smaller than its direct effect.

We now turn to the analysis of image characteristics and their potential relationship to trustworthiness. As expected, a multi-person photo increased perceived attractiveness. However, we also find a strong *direct positive effect* of multi-person photos on trustworthiness, 70% of the positive effect of multi-person photos on perceived is direct. The results further reveal that the

quality of the photograph also plays a significant role in determining trustworthiness. Photo quality increases perceived trustworthiness both directly (60%) and indirectly (40%) by increasing attractiveness. Despite our expectations, the results suggest no significant evidence for direct or indirect effects of facial clarity on perceived trustworthiness.

Discussion and Conclusions

The use of personal photos online began in social network platforms such as Facebook and LinkedIn, and has become widespread. It is especially prominent in sharing economy platforms, such as Uber, Eatwith, and Airbnb, and recent research has documented how it affects economic transactions by signaling trust (Ert et al., 2016). In this article, we used SEM to identify the direct and indirect effects of facial and image characteristics on the inference of trustworthiness from Airbnb hosts' images. The main contribution of this study is the use of a naturalistic set of images that allowed us to explore: (a) whether the effect of facial characteristics on trustworthiness found with controlled headshot photos could be generalized to the context of online photos that people post and (b) the role of image characteristics, such as multi-person pictures and photo quality, in inferring trustworthiness. The results reveal that the effect of facial characteristics on perceived trustworthiness can indeed be generalized to natural photos and that image characteristics also affect trustworthiness both directly and indirectly. These results have theoretical and practical implications not only for facial trait modelling, but also for image trait inference. It is possible that the effect of image characteristics on perceived trustworthiness may stem from their suggestive indirect implications about the person who posted them. For example, a photo of low quality might hint that the person is inattentive to detail, while a group photo might suggest that the person who posted such a photo is friendly.

We did not explore these possibilities in this study but future research may further explore the inferences people make based on image attributes and if so whether they do so consciously or unconsciously.

The SEM analysis also allows for the quantification of each effect and the evaluation of the relative magnitude of its direct and indirect effects on trustworthiness. This is especially important when these effects oppose one another, as in the case of age. Similarly to previous research, we found that the total effect of age on perceived trustworthiness is positive. Nevertheless, breaking the total effect down into its components not only provides insight into the direction of the effect, but also sheds light on its magnitude. We show that the direct effect of age on trustworthiness is greater than its indirect effect, yet its negative impact on attractiveness reduces its full effect. In our case, the total effect was significantly positive, but under different conditions, these two opposing effects might cancel each other out and could lead to the conclusion that age does not significantly affect trustworthiness.

The current study also provides a fresh insight that explains the prevalent evidence of the strong correlation between attractiveness and trustworthiness. We show that this correlation is explained by the positive correlation of both smiling and gender with both attractiveness and trustworthiness. Thus, while the net correlation of attractiveness with trustworthiness is significant, it is smaller than might have been expected once we control for other predictors, such as gender and smiling.

It seems tempting to suggest that the images, although taken from Airbnb, were evaluated outside of their context and therefore might even apply to many other platforms in which personal photos are prominent, such as Facebook, LinkedIn, Instagram, and others. The finding that most effects of facial characteristics are relevant to natural photos that present more than

only a face suggests that such inferences may indeed be generalizable across contexts. Nevertheless, it is also possible that the effect of some inferences might differ across contexts and that there may be common unobserved features for photos in certain contexts. For example, photos posted on Airbnb might share a common feature that relates to a business environment and might be different in that sense from photos posted on Facebook. Another relevant factor that should be further explored in future research is cultural differences in these inferences. Our sample consists of photos posted by Caucasians that were evaluated by Americans. Other cultures might interpret facial and/or image characteristics differently. Future research should examine these possibilities, yet the finding that people make instant inferences from facial and image characteristics when exposed to online photos suggests that this phenomenon is a general one.

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Table 1: Expected directions of the effects of facial and image characteristics on perceived attractiveness and trustworthiness. The symbols "+" and "-" refer to positive and negative relation respectively.

	Perceived Attractiveness	Perceived Trustworthiness
Attractiveness	N.A.	+
Facial characteristics		
Smile	+	+
Age	-	+
Female	+	+
Image characteristics		
Multi-person	+	+
Facial clarity	+	+
Quality	+	+

Table 2: Descriptive statistics and zero-order correlations among key variables

		Scale	M	SD	1	2	3	4	5	6	7	8
1.	Trustworthiness	1-10	6.11	0.96	-	.49***	.61***	.28***	.17**	.15**	.43***	.32***
2.	Attractiveness	1-10	5.99	1.20		-	.30***	.26***	.10	-.43***	.38***	.15**
3.	Smile	y/n	0.68	0.38			-	.16**	.20***	.06	.22***	.25***
4.	Female	y/n	0.49	0.50				-	-.37***	.12*	.07	.01
5.	Multi-person	y/n	0.13	0.34					-	-.08	.04	.03
6.	Age	.	33.5	7.86						-	.01	.18**
7.	Quality	1-10	6.19	1.00							-	.55***
8.	Face seen clearly	y/n	0.87	0.23								-

*p<0.05, **p<0.01, ***p<0.001.

Table 3: SEM Estimation of the Model Parameters

Outcome	Direct effect	Indirect effect	Total effect	Proportions	
				Direct	Indirect
Attractiveness					
Smile	0.54***	-	0.54***	-	-
	(0.14)		(0.14)		
Female	0.77***	-	0.77***	-	-
	(0.11)		(0.11)		
Multi-person	0.46**	-	0.46**	-	-
	(0.16)		(0.16)		
Age	-0.07***	-	-0.07***	-	-
	(0.006)		(0.006)		
Quality of photo	0.31***	-	0.31***	-	-
	(0.05)		(0.05)		
Face seen clearly	0.11	-	0.11	-	-
	(0.26)		(0.26)		
Trustworthiness					
Attractiveness	0.30***	-	0.30***	-	-
	(0.03)		(0.03)		
Smile	1.00***	0.16**	1.15***	86%	14%
	(0.09)	(0.04)	(0.10)		
Female	0.21***	0.23***	0.45***	49%	51%
	(0.08)	(0.05)	(0.08)		
Multi-person	0.32**	0.14**	0.46***	70%	30%
	(0.11)	(0.05)	(0.12)		
Age	0.03***	-0.02***	0.01**	62%[1]	28%[1]
	(0.005)	(0.003)	(0.004)		
Quality of photo	0.14***	0.09***	0.23***	60%	40%
	(0.05)	(0.011)	(0.03)		
Face seen clearly	0.05	0.03	0.08	62%	38%
	(0.18)	(0.07)	(0.19)		
N=320					

*p<0.05, **p<0.01, ***p<0.001.

[1] The proportional effect of age on perceived trustworthiness was calculated in absolute values, since the direct effect has a positive value and the indirect effect has a negative value.

Figure 1: SEM predicting perceived trustworthiness and attractiveness by facial and image characteristics (the weights included in the figure are unstandardized beta weights)

*p<0.05, **p<0.01, ***p<0.001.