All the Dark Triad and Some of the Big Five Traits are Visible in the Face

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All face images used in the studies are retrieved from <https://osf.io/evs7z/>

All data and analysis codes are accessible at

https://osf.io/dbxe5/?view_only=2540de9ebdcf448cbf564efb1c721a43

Abstract

Some of the recent studies suggested that people can make accurate inferences about the level of the Big Five and the Dark Triad personality traits in strangers by only looking at their faces. However, later findings provided only partial support and the evidence is mixed regarding which traits can be accurately inferred from faces. In the current research, to provide further evidence on whether the Big Five and the Dark Triad traits are visible in the face, we report three studies, two of which were preregistered, conducted on both WEIRD (the US American) and non-WEIRD (Turkish) samples ($N = 880$). The participants in both US American and Turkish samples were successful in predicting all Dark Triad personality traits by looking at a stranger's face. However, there were mixed results regarding the Big Five traits. An aggregate analysis of the combined dataset demonstrated that extraversion (only female), agreeableness, and conscientiousness were accurately inferred by the participants in addition to the Dark Triad traits. Overall, the results suggest that inferring personality from faces without any concrete source of information would be an evolutionarily adaptive trait.

Keywords: Big five, Dark Triad, face perception, personality, zero acquaintance

All the Dark Triad and Some of the Big Five Traits are Visible in the Face

Estimating the personality traits of others has adaptive advantages such as being aware of the opportunities and costs that the other party can offer (i.e., prosocial vs. exploitative personality) and it can guide us about behaving and making decisions in our social interactions. In the current research, we aim to test whether humans can successfully infer the Big Five (e.g., McCrae & Costa, 1985) and the Dark Triad (e.g., Paulhus & Williams, 2002) personality traits by looking at a stranger's face without any concrete source of information.

Personality, the Big Five and the Dark Triad

The research in personality psychology has accumulated extensive evidence on different dimensions of personality (e.g., Ashton et al., 2004; Borgatta, 1964; McCrae & Costa, 1985; Norman, 1963; Paulhus & Williams, 2002; Tupes & Christal 1961). Among these, the Big Five and the Dark Triad models of personality have been cross-culturally validated, and they are currently two well-known models in defining personality (O'Boyle, Forsyth, Banks, Story, & White, 2015). Various studies have determined features associated with those models and shed light on how different personality traits are linked to behavioral outcomes in social life (e.g., Borkenau & Müller, 1992; Cohen, 2016; Costa & McCrae, 1988; Crysel, Crosier, Webster, & 2013; Furnham, Chamorro-Premuzic, & McDougall, 2002; Garcia & Sikström, 2014; Jensen-Campbell, Rosselli, Workman, Santisi, Rios, & Bojan 2002; Jonason & Kavanagh, 2010; Mehls, Gosling, & Pennebaker, 2006; Pabian, De Backer, & Vandebosch, 2015; Paunonen & Ashton, 2001; Schmitt, Allik, McCrae, & Benet-Martínez, 2007).

The Big Five traits. One of the best-known personality models is the Big Five Model, suggesting that personality can be grouped under five different dimensions, namely neuroticism, extraversion, openness, agreeableness, and conscientiousness (Costa & McCrae,

1992; McCrae & Costa, 1985). Neuroticism is defined as being exciting, anxious, insecure, irritable, and higher levels of neuroticism exhibit an unbalanced emotional mood and higher levels of excitability. Extraversion expresses characteristics of affectionate, loving to be together with people, sociality, assertiveness, and mobility. Openness is a trait related to strong imagination, a desire to accept new ideas, multi-dimensional thinking, and mental curiosity. Agreeableness indicates traits such as trustworthiness, frankness, compatibleness, altruism. Lastly, conscientiousness is the personality trait that reflects being careful, diligent, self-disciplined and tendency to be responsible (McCrae & Costa, 2008; McCrae & John, 1992). It has been observed that individuals from many different cultures with different languages identify themselves and others with almost the same concepts that can be included in these five personality dimensions (Alper & Yilmaz, 2019; Schmitt et al., 2007; Yamagata et al., 2006).

The Dark Triad traits. Another frequently studied personality model is the Dark Triad (Paulhus & Williams, 2002). The “dark” expression in the concept emphasizes the social disturbance these traits are associated with (Thomaes, Brummelman, Miller, & Lilienfeld, 2017). Based on the research in the personality literature, Paulhus and Williams (2002) argued that three malevolent personality traits, *Machiavellianism*, *narcissism*, and *psychopathy*, are universally prominent. Machiavellianism, emerging from Niccolo Machiavelli’s books, expresses emotional coldness, cynism, manipulative behaviors, and deceptive traits (Christie & Geis, 1970; Jakobwitz & Egan, 2006; Kessler, Bandelli, Spector, Borman, Nelson, & Penney, 2010). The construct of narcissism is characterized by grandiosity, self-love, being dominant, and superior to others (Campbell, Brunell, & Finkel, 2006; Paulhus & Williams, 2002). Psychopathy is a trait associated with selfishness, impulsivity, deceitfulness, and lack of interpersonal affect (Hare & Neumann, 2008; Harpur, Hare, Hakstian, 1989). Although the dimensions of the Dark Triad have diverse origins, they share mutual malevolent qualities

such as emotional coldness, self-promotion, duplicity, manipulation, and aggression (Paulhus & Williams, 2002). Research suggests that these three facets of the Dark Triad have an empirically overlapping pattern although they are conceptually distinct (Furnham, Richards, & Paulhus, 2013). They are found to be associated with risking others for personal gain (Jones, 2013), counter-productive leadership in workplace (Penney & Spector, 2002), exam cheating (Nathanson, Paulhus, & Williams, 2006), desire to power and vanity (Lee, Ashton, Wiltshire, Bourdage, Visser, & Gallucci, 2013), exploitative short-term mating strategies (Jonason, Li, Webster, & Schmitt, 2009), prejudice against outgroups (Hodson, Hogg, & MacInnis, 2009), and antisocial behaviors such as bullies (Baughman, Dearing, Giammarco, & Vernon, 2012), or deviant fantasies (Baughman, Dearing, Giammarco, & Vernon, 2012; Williams, Cooper, Howell, Yuille, & Paulhus, 2009).

Inferring Personality Traits from Faces

As discussed, the personality type of a person is related to socially relevant traits, such as being trustworthy or exploitative in social interaction. Thus, people tend to have a motivation to determine the personality traits of others and sometimes rely on first impressions even if there is no concrete source of information (Back, Schmukle, & Egloff, 2008). Such situations are called *zero acquaintance* which refers to the situation in which individuals make inferences about the traits of others when there are no prior interactions and behavioral/attitudinal information about the target (Albright, Kenny, & Malloy, 1988; Ambady, Hallahan, & Rosenthal, 1995). Recent studies have shown that individuals can make accurate predictions about others in the zero acquaintance conditions, even from solely photographs of their faces.

For example, Penton-Voak, Pound, Little, and Perrett (2006) asked the participants to evaluate the photographs of male and female faces in the high and low categories in terms of the Big Five personality traits. In the first study, participants were shown photographs of real

individuals randomly selected from the pool. It was found that the participants were able to detect low and high extravert individuals by making correct inferences. In addition, successful inferences were also made on the neuroticism and openness to the experience levels of male faces. In the second study, composite photographs were created from individuals with low and high scores in the Big Five personality traits. The best distinguishable dimension was found to be agreeableness. A similar pattern was observed in extraversion (including males and females), and neuroticism (for male targets only). As a result, composite photographs were found to be more accurate than individual photographs (Penton-Voak et al., 2006). Other research also provided evidence that accurately detecting extraversion individuals' faces is faster compared to other Big Five traits (Borkenau, Brecke, Möttig, & Paelecke, 2009), suggesting the intuitive nature of this inference. In addition, Little and Perrett (2007) divided individuals into two groups as high and low in terms of each Big Five personality traits, which were measured by the self-report scale, and created composite face photographs for two groups on each personality trait. Then, they asked participants to make evaluations about the personality of these face photographs. Results showed that inferences based on composite photographs were noticeably accurate.

Concordantly, there is also some evidence suggesting that inferring personality from faces are possible for the Dark Triad. Similar to the study of Little and Perrett (2007), Holtzman (2011) created composite face photographs of individuals exhibiting high and low scores on the Dark Triad traits by relying on self- and peer-reports. Participants identified all Dark Triad personality traits accurately by only looking at composite face photographs. Psychopathy was the most accurately inferred dimension. Additionally, female targets were more easily determined compared to male targets. Shiramizu, Kozma, DeBruine, and Jones (2019) conceptually replicated the study of Holtzman (2011) by creating their own composite photographs. Unlike Holtzman (2011) who utilized both self- and peer-reports, Shiramizu and

colleagues (2019) used only self-reports to measure the Dark Triad traits. They found that the inferences are accurate on the narcissism dimension for both male and female targets, on the psychopathy for only male targets, and inaccurate for Machiavellianism. Therefore, Holtzman's findings were only partially replicated in this study.

In addition to this failure to replicate, a recent large-scale study including 137,163 participants cast doubt on the assumption that the facial characteristics of an individual predict various behavioral tendencies, by showing that facial width-to-height ratio does not predict behavioral tendencies (Kosinski, 2017). Considering mixed results in the literature, we believe there is a need for further investigation of this topic.

In the current research, we aim to provide further evidence regarding whether the Big Five and the Dark Triad traits are visible in strangers' faces. To achieve this, we conduct three studies, two of which (Study 2 and 3) were preregistered prior to data collection, on large samples ($N = 880$), using the face images previously developed by Holtzman (2011). We also test the accuracy of perception of personality traits in different cultures by recruiting samples from both WEIRD (the US) and non-WEIRD (Turkey) cultures. Considering that similar previous studies (e.g., Holtzman, 2011; Shiramizu et al., 2019) depended on WEIRD samples, we argue that the lack of data from non-WEIRD samples was an important limitation in the literature (Henrich, Heine, & Norenzayan, 2010), which we aim to overcome. Another novel contribution of the current set of studies is that we test the accuracy of prediction of both the Big Five and the Dark Triad traits, unlike Holtzman (2011) and Shiramizu et al. (2019) who only investigated the visibility of the Dark Triad traits in the face.

Study 1

Participants

We have recruited 160 US American participants via Amazon Mechanical Turk. Participants were paid \$0.30 for their participation.¹

Materials

We used face images provided by Faceaurus database (<http://www.nickholtzman.com/faceaurus.htm>; Holtzman, 2011). Faceaurus includes digital combinations of face images of people with high or low scores on the Big Five (agreeableness, conscientiousness, neuroticism, openness, extraversion; John & Srivastava, 1999; McCrae & Costa, 1999) and the Dark Triad (narcissism, psychopathy, Machiavellianism; Paulhus & Williams, 2002) personality traits. Holtzman (2011) had 209 participants complete questionnaires on the Dark Triad (Christie & Geis, 1970; Raskin & Terry, 1988; Oltmanns & Turkheimer, 2006; Paulhus, Neumann, & Hare, in press) and the Big Five (Yarkoni, 2010) traits. In addition to self-reports, peer reports from participants' acquaintances were also retrieved. The peers responded to customized measures of the Dark Triad (see Holtzman, 2011) and the Big Five (Gosling, Rentfrow, & Swann, 2003) traits. Holtzman (2011) standardized the assessment scores, computed average scores of self- and peer-reports, and ranked the face images based on the resulting scores. Then, prototypes for each of the personality dimensions were created by digitally combining 10 faces with the highest and 10 faces with the lowest scores on the personality trait in question (Holtzman, 2011). The resulting face images are provided in Figure 1.

¹ We had anticipated that the task would only take a few minutes. Expectedly, the median completion time was found to be 137.5 seconds. A payment of \$0.30 for 137.5 seconds equals to \$7.85/hour which is higher than the federal minimum wage of \$7.25/hour.

Figure 1. The composite face images used in the current research. All images were retrieved from Faceaurus database (Holtzman, 2011). Face images are accessible at <https://osf.io/evs7z/>.

Procedure

Participants were told that the study is about guessing someone's personality by only looking at his/her face and they were directed to complete an online questionnaire. In order to control for bots, we included a Completely Automated Public Turing test to tell Computers and Humans Apart (CAPTCHA) at the beginning and those who failed at CAPTCHA were not allowed to proceed.

As there were male and female versions of comparisons on a total of 8 personality traits, we had 16 sets of images. In each set, two faces were presented side by side, participants were provided with a brief definition of the related personality trait (see Table 1), and they were asked to guess which person (Person 1 or Person 2) had a higher score on that trait. The order of appearance of sets and positioning of the images (on the left or the right side of the screen) were randomized for each participant. All data and materials are available at https://osf.io/dbxe5/?view_only=2540de9ebdcf448cbf564efb1c721a43.

Table 1

Definitions used for each dimension of the Big Five and the Dark Triad personality traits

Personality Trait	Definition
Agreeableness (Big Five)	“The tendency to agree and go along with others rather than to assert one’s own opinions and choices.”
Conscientiousness (Big Five)	“The tendency to be careful, on-time for appointments, to follow rules, and to be hardworking.”
Extraversion (Big Five)	“The tendency to be talkative, social, and to enjoy others; the tendency to have a dominant style.”
Neuroticism (Big Five)	“The tendency to frequently experience negative emotions such as anger, worry, and sadness, as well as being interpersonally sensitive.”
Openness (Big Five)	“The tendency to appreciate new art, ideas, values, feelings, and behaviors.”
Narcissism (Dark Triad)	“The tendency to be arrogant, vain, pompous, self-absorbed, and assertive.”
Psychopathy (Dark Triad)	“The tendency to be reckless, antagonistic, assertive with others, and angry at others.”
Machiavellianism (Dark Triad)	“The tendency to be manipulative for personal gain; scheming; conspiring.”

Note. Definitions of the Big Five personality traits were taken from Diener and Lucas (2019) and definitions of Dark Triad traits were taken from Holtzman (2011).

Results

We performed binomial tests to investigate whether participants could accurately identify the face with a higher score on the relevant personality trait with a correct response rate that is significantly ($p < .05$) higher than 50%. The results are reported in Table 2.

Table 2

Accuracy in judgments of the Big Five and the Dark Triad traits in Study 1

	N	Face sex	Percentage of correct responses	$\chi^2(1)$	p-value
Agreeableness	159	Female	%58.49	4.585	0.032
	160	Male	%71.25	28.900	< 0.001
Conscientiousness	160	Female	%52.50	0.400	0.527
	160	Male	%55.00	1.600	0.206
Extraversion	160	Female	%71.88	30.625	< 0.001
	160	Male	%41.25	4.900	0.027
Neuroticism	160	Female	%39.38	7.225	0.007
	160	Male	%43.13	3.025	0.082
Openness	160	Female	%42.50	3.600	0.058
	160	Male	%35.63	13.225	< 0.001
Narcissism	160	Female	%62.50	10.000	0.002
	159	Male	%55.97	2.270	0.132
Psychopathy	160	Female	%64.38	13.225	< 0.001
	160	Male	%67.50	19.600	< 0.001
Machiavellianism	159	Female	%62.26	9.566	0.002
	160	Male	%60.00	6.400	0.011

Note. Lines written in boldface show accurate trait predictions for which the proportion of correct responses was significantly ($p < .05$) higher than %50.

Except for the comparison of male faces with higher and lower narcissism, participants successfully predicted the face with a higher score for all Dark Triad-related comparisons. For Big Five, however, participants' choices were not very accurate: Except for male and female

comparisons of agreeableness and female comparison of extraversion, the correct response rate was not higher than 50% for the Big Five traits. In short, Dark Triad, but not Big Five, traits were found to be mostly identifiable by only looking at someone's face.

Study 2

In Study 2, we replicated Study 1 on a larger sample using a different subset of participants on Amazon Mechanical Turk. We preregistered our study design and analysis procedure prior to data collection (<https://osf.io/y57t9>). We attached a copy of the questionnaire and analysis syntax to the preregistration form. All reported confirmatory analyses are conducted by running the preregistered analysis syntax.

The lowest but still statistically significant accuracy rate in Study 1 was approximately 58% (for agreeableness – male). Assuming an effect size of $w = .16$ (which corresponds to this accuracy rate) and taking alpha as .05 and power as .80, we calculated that we needed a minimum of 307 participants. We reached a total of 340 participants. Nine participants took an unreasonably long time to complete the study (z score for the duration was larger than 3) and they were removed from the analysis, following the preregistered procedure.² This led to a resulting sample size of 322 (142 females; $M_{\text{age}} = 37.58$, $SD = 11.83$). Study 2 was identical to Study 1, except for that participants also reported their age, sex, and ideology³ (1 = *very liberal*, 7 = *very conservative*) at the end of the survey. All data and materials are available at https://osf.io/dbxe5/?view_only=2540de9ebdcf448cbf564efb1c721a43.

² This exclusion criterion was stated in the preregistration form but we have accidentally omitted this part in the preregistered syntax. The only difference between the preregistered and the used syntax was that we added a part which removes outliers, following the procedure described in the preregistration form.

³ As stated in the preregistration form, ideology question was added for potential exploratory analyses that might be conducted in the future and they are not included in the confirmatory analyses.

Results

Similar to Study 1, we performed binomial tests to investigate the accuracy rates in judgments. The results are presented in Table 3. All Dark Triad traits had percentages of correct responses that were significantly higher than 50%, very similar to Study 1.

Participants also successfully chose the faces with higher agreeableness and conscientiousness scores, both for male and female faces. Female face with a higher extraversion level was also chosen with a high accuracy rate. The other five comparisons related to the Big Five traits did not have a correct response rate that is significantly higher than 50%. For most of these comparisons (extraversion – male, neuroticism – female and male, openness – female and male), the accuracy rate was significantly below 50%. Thus, consistent with Study 1, the Dark Triad traits were found to be visible in the face. The results on the Big Five traits, however, were mixed.

Table 3

Accuracy in judgments of the Big Five and the Dark Triad traits in Study 2

	N	Face sex	Percentage of correct responses	$\chi^2(1)$	p-value
Agreeableness	316	Female	64.56%	26.785	< 0.001
	316	Male	70.57%	53.481	< 0.001
Conscientiousness	318	Female	56.29%	5.031	0.025
	317	Male	55.52%	3.864	0.049
Extraversion	317	Female	71.61%	59.208	< 0.001
	316	Male	43.67%	5.063	0.024
Neuroticism	317	Female	38.49%	16.811	< 0.001
	316	Male	45.25%	2.848	0.091
Openness	317	Female	36.28%	23.877	< 0.001
	317	Male	33.12%	36.117	< 0.001
Narcissism	318	Female	66.35%	34.013	< 0.001
	316	Male	61.71%	17.329	< 0.001
Psychopathy	318	Female	68.24%	42.314	< 0.001
	316	Male	69.30%	47.101	< 0.001
Machiavellianism	316	Female	66.46%	34.228	< 0.001
	318	Male	58.49%	9.170	0.002

Note. Lines written in boldface show accurate trait predictions for which the proportion of correct responses was significantly ($p < .05$) higher than %50.

Study 3

In Study 3, we replicated Study 2 on a Turkish, non-WEIRD sample (Henrich, Heine, & Norenzayan, 2010). Study design and analysis plan were preregistered prior to data collection (<https://osf.io/hgwfy>). The sample consisted of Turkish undergraduate students who participated in exchange for partial course credit. Similar to Study 2, we aimed for a minimum of 307 participants and ended up with 406. Four participants took longer than expected time to complete the study (z score for the duration was larger than 3), following the preregistered procedure. The resulting sample size was 402 (339 females; $M_{\text{age}} = 20.77$, $SD = 1.94$).

Study 3 was identical to Study 2, except for the following three differences: (1) Instructions and questions were translated into Turkish; (2) participants were asked to bring their smartphones to the classroom; they were given a link to the study; and all students in the same class participated in the study in a classroom environment at the same time so that we could make sure that they were not interacting with each other or distracted by anything else; (3) we did not include a CAPTCHA as all participants were undergraduate students who participated for credit. All data and materials are accessible at https://osf.io/dbxe5/?view_only=2540de9ebdcf448cbf564efb1c721a43. The results are reported in Table 4.

Table 4

Accuracy in judgments of the Big Five and the Dark Triad traits in Study 3

	N	Face sex	Percentage of correct responses	$\chi^2(1)$	p-value
Agreeableness	402	Female	60.70%	18.398	< 0.001
	402	Male	65.92%	40.756	< 0.001
Conscientiousness	402	Female	54.73%	3.592	0.058
	402	Male	58.96%	12.896	< 0.001
Extraversion	402	Female	75.12%	101.502	< 0.001
	402	Male	31.59%	54.477	< 0.001
Neuroticism	402	Female	41.29%	12.189	< 0.001
	402	Male	44.28%	5.264	0.022
Openness	402	Female	33.33%	44.667	< 0.001
	402	Male	25.87%	93.622	< 0.001
Narcissism	402	Female	73.13%	86.060	< 0.001
	402	Male	67.16%	47.373	< 0.001
Psychopathy	402	Female	72.64%	82.398	< 0.001
	402	Male	74.13%	93.622	< 0.001
Machiavellianism	402	Female	68.16%	53.025	< 0.001
	402	Male	63.43%	29.015	< 0.001

Note. Lines written in boldface show accurate trait predictions for which the proportion of correct responses was significantly ($p < .05$) higher than %50.

Similar to Study 1 and 2, all Dark Triad traits were successfully identified (i.e., percentages of correct responses were significantly higher than 50%) in prototypical faces. For the Big Five traits, the results were more mixed: Participants were successful in predicting

agreeableness in male and female faces, conscientiousness in male faces, and extraversion in female faces, consistent with Study 2. Another similarity with Study 2 was that the accuracy rates were significantly below 50% for the following: Extraversion (male), neuroticism (female and male), and openness (female and male).

Next, we combined the data from all studies to illustrate the overall results (see Table 5). When all data were merged, participants had an accuracy level that is significantly higher than 50% detecting agreeableness (male and female), conscientiousness (male and female), extraversion (female), and all Dark Triad traits (male and female).

Table 5

Accuracy in judgments of the Big Five and the Dark Triad traits in the combined data of all studies

	N	Face sex	Percentage of correct responses	$\chi^2(1)$	p-value
Agreeableness	877	Female	61.69%	47.919	< 0.001
	878	Male	68.56%	121.043	< 0.001
Conscientiousness	880	Female	54.89%	8.405	0.004
	879	Male	57.00%	17.212	< 0.001
Extraversion	879	Female	73.27%	190.308	< 0.001
	878	Male	37.70%	53.139	< 0.001
Neuroticism	879	Female	39.93%	35.642	< 0.001
	878	Male	44.42%	10.938	0.001
Openness	879	Female	36.06%	68.288	< 0.001
	879	Male	30.26%	136.984	< 0.001
Narcissism	880	Female	68.75%	123.750	< 0.001
	877	Male	63.17%	60.485	< 0.001
Psychopathy	880	Female	69.55%	134.473	< 0.001
	878	Male	71.18%	157.613	< 0.001
Machiavellianism	877	Female	66.48%	95.235	< 0.001
	880	Male	61.02%	42.768	< 0.001

Note. Lines written in boldface show accurate trait predictions for which the proportion of correct responses was significantly ($p < .05$) higher than %50.

We also compared the accuracy levels of the US American (the combination Study 1 and 2) and Turkish (Study 3) samples. Among the Big Five traits, the only differences were regarding extraversion-male and openness-male categories: For extraversion-male, the US

American participants' accuracy rate (42.86%) was significantly higher than Turkish participants (31.59%), $\chi^2(1) = 11.776, p = .001$. For openness-male, similarly, the US American participants (33.96%) were more successful than Turkish participants (25.8%), $\chi^2(1) = 6.768, p = .009$. However, it should be noted that, in both cases, the accuracy rates were significantly below the level of 50%.

Among the Dark Triad traits, the only differences were regarding narcissism: For the narcissism-female category, Turkish participants (73.13%) had higher accuracy rates than the US Americans (65.06%), $\chi^2(1) = 6.622, p = .010$. For the narcissism-male category, similarly, the Turkish participants (67.16%) were more successful than the US American, $\chi^2(1) = 5.090, p = .024$. The other differences were not statistically significant. All findings regarding the differences between the US American and Turkish samples are available at https://osf.io/dbxe5/?view_only=2540de9ebdcf448cbf564efb1c721a43.

Discussion

Across three studies spanning WEIRD (US Americans) and non-WEIRD (Turkish) samples, we found that (1) all Dark Triad traits were found to be visible in prototypical faces; (2) the results were mixed about the Big Five traits with agreeableness being the most consistently identifiable trait in both male and female faces; (3) with regard to extraversion, neuroticism, and openness, the participants tended to make the wrong choice by picking the faces with lower scores and had accuracy rates that were significantly below 50%. The aggregate analysis of the combined dataset supported these initial findings and conclusively showed that in addition to all Dark Triad traits, agreeableness, conscientiousness (males and females), and extraversion (female) traits were accurately identified by the participants.

Therefore, the current findings replicate Holtzman's (2011) initial findings regarding Dark Triad traits in two different cultures spanning WEIRD and non-WEIRD samples and

also extend those to some (but not all) aspects of the Big Five traits. Although the Dark Triad traits are visible in prototypical faces, inconsistent results across three samples regarding the Big Five traits call into question whether the tendency to infer personality from faces generalizes to the Big Five personality traits unlike previous literature (e.g., Penton-Voak et al., 2006). Overall, the consistent inferences regarding the Dark Triad traits converge with Holtzman's (2011), and partially with Shiramizu et al.'s (2019) previous findings, whereas inconsistent findings regarding the Big Five traits might converge with Kosinski's (2017) large-scale failed replication attempt suggesting that the previously shown associations between facial characteristics and behavioral tendencies do not produce strong evidence as previously assumed.

Why did we find evidence for all Dark Triad and only three facets of the Big Five personality traits? Previous literature on personality psychology suggests that human faces have a central role in social perception and cognition as it can rapidly provide a rich source of information about stable social categories (e.g., sex, age, race) and situational variables such as physical health, emotions, and intentions without requiring too much cognitive energy (Hugenberg & Wilson, 2013; Parkinson, 2005). It plays an important role in social interactions, involving messages about many emotion categories through signaling muscles (Du, Tao, & Martinez, 2014). Therefore, during face-to-face contact, the first impression of others can be decisive (Carney, Colvin, & Hall, 2007), which in turn might give potential cooperation partner the high sign as to whether the other party has either a cooperative or an exploitative profile. In short, identifying personality traits from faces would be an adaptive feature that serves humans to survive by making it easier to gain pros and avoid cons (Sacco & Hugenberg, 2009). For example, those who report higher scores on extraversion, agreeableness, and conscientiousness are more likely to exhibit prosocial behavioral motivations (Carlo, Okun, Knight, & Guzman, 2005). Extravert individuals are also more

likely to report positive emotions, gregariousness, and assertiveness (McCrae & Costa, 1999), and parental nurturance (Metsäpelto & Pulkkinen, 2003). Moreover, the extraversion dimension can be easily determined among other Big Five traits especially in interpersonal behaviors (Borkenau, Mauer, Riemann, Spinath, & Angleitner, 2004). For instance, observations about a joke, social activity, facial expression, posture, and smiling may result in an accurate determination of the extraversion trait level of the target (Borkenau, Mauer, Riemann, Spinath, & Angleitner, 2004; Naumann, Vazire, Rentfrow, & Gosling, 2009). Therefore, detecting extraversion may be facilitating preference for such faces and correspond to satisfying affiliative needs (Sacco & Hugenberg, 2009). Similarly, detecting agreeable and conscientious individuals might signal their potential to cooperate, whereas detecting individuals with exploitative personality traits (i.e., Dark Triads) might make it easier to avoid potential costs. For example, the Dark Triad personality traits are associated with low quality of job performance (O'Boyle, Forsyth, Banks, & McDaniel, 2012), cheat, lie, and betray others (Jones & Paulhus, 2009), and aggression in interpersonal relationships (Buffardi & Campbell, 2008). Therefore, detecting individuals indicating the Dark Triad personality traits may trigger aversion due to the need for protection from potential dangers (i.e., interpersonal harm), which in turn might lead those individuals to be excluded from altruistic interactions. In other words, inferring personality from faces for these domains of personality would serve specific functions, and thus would be evolutionarily adaptive.

Previous studies demonstrated that it is possible to make accurate inferences about the Big Five personality traits of others by considering their music preferences (Rentfrow & Gosling, 2006), e-mails (Back, Schmuckle, & Egloff, 2008), workspace and bedrooms (Gosling, Ko, Mannarelli, & Morris, 2002), stream of consciousness essays (Holleran & Mehl, 2008), and avatar pictures on social networks (Bélisle & Bodur, 2010; Fong & Mar, 2015). In addition, accurate inferences can be made for the Big Five by looking at online

social network accounts that contain profile picture, interest field, and notice board (Stopfer, Egloff, Nestler, & Back, 2014). However, all of these studies produced strong evidence for some (but not all) of the facets of the Big Five, and it is difficult to reconcile these mixed findings. The aggregate analysis of the data from the current study also produced evidence supporting that inferring personality from faces is only accurate for three aspects of the Big Five traits (agreeableness and conscientiousness for males and females, and extraversion for females) but not accurate for neuroticism, and openness. In other words, different results have been obtained regarding which personality dimensions are most easily and accurately determined. Using different datasets of face photographs (i.e., composite vs. individual photos), different genders as target (i.e. males vs. females), different sampling procedures (student vs. community samples), and different cultures as sample (i.e., WEIRD vs. non-WEIRD) might lie behind these mixed findings. Future studies should use representative samples as well as more ecologically valid tools adapted for several ethnic groups (i.e., moving beyond white samples) to reconcile these mixed findings.

Future research investigating the facial cues of personality are also recommended to take into account further details that might influence the face perception process. For example, past research suggests that personality inferences from the faces can be influenced by variables such as the size of the eyes and the maturity of the face (Berry & Brownlow, 1989; Sacco & Hugenberg, 2009). In addition, facial expressions (i.e., smiling, frowning) might have an influence, thus using neutral faces in the face photographs might not be the ideal way of studying face-personality link, on which the vast majority of literature has relied. New technological advances are promising, including automated 3D human face creation and suggest a high potential impact on this area of research. We believe that the future research should make use of more carefully designed materials to tap into the question of visibility of personality in the face.

All in all, the current studies contribute to the literature with three samples spanning two geographically diverse cultures indicating that inferring personality can be made only by looking at the human face. All Dark Triad and some of the Big Five traits were accurately predicted across all samples which suggests that certain aspects of personality are indeed visible in the face.

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