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All the Dark Triad and some of the Big Five traits are visible in the face

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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 the 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 might be an evolutionarily adaptive trait.

1. Introduction

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 (McCrae & Costa, 1985) and the Dark Triad (Paulhus & Williams, 2002) personality traits by looking at a stranger's face without any concrete source of information.

1.1. 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 used in various context about personality and its associations with social outcomes (Furnham et al., 2013; O'Boyle et al., 2015; Schmitt et al., 2007). 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 et al., 2013; Furnham et al., 2002; Garcia & Sikström, 2014; Jensen-Campbell et al., 2002; Jonason & Kavanagh, 2010; Mehl et al., 2006; Pabian et al., 2015; Paunonen & Ashton, 2001; Schmitt et al., 2007).

1.1.1. 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 affectionateness, 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, and altruism. Lastly, conscientiousness is the personality trait that reflects being careful, diligent, self-disciplined, and having a 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).

1.1.2. 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 et al., 2017). Based on the research in the personality literature, Paulhus and Williams (2002) argued *Machiavellianism, narcissism*, and *psychopathy* are three of the malevolent personality traits that attracted the most attention. Machiavellianism, emerging from Niccolo Machiavelli's books, expresses emotional coldness, cynism, manipulative behaviors, and deceptive traits (Christie & Geis, 1970; Jakobwitz & Egan, 2006; Kessler et al., 2010). The construct of narcissism is characterized by grandiosity, self-love, dominance, and superiority to others (Campbell et al., 2006; Paulhus & Williams, 2002). Psychopathy is a trait associated with selfishness, impulsivity, deceitfulness, and lack of interpersonal affect (Hare & Neumann, 2008; Harpur et al., 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 et al., 2013). They are found to be associated with risking others for personal gain (Jones, 2013), counterproductive leadership in the workplace (Penney & Spector, 2002), exam cheating (Nathanson et al., 2006), a desire to power and vanity (Lee et al., 2013), exploitative short-term mating strategies (Jonason et al., 2009), prejudice against outgroups (Hodson et al., 2009), and antisocial behaviors such as bullies (Baughman et al., 2012), or deviant fantasies (Baughman et al., 2012; Williams et al., 2009).

1.2. 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 et al., 2008). Such situations are called *zero acquaintance*, as they refer to the situation in which individuals make inferences about the traits of others when there is no prior interactions and behavioral/attitudinal information about the target (Albright et al., 1988; Ambady et al., 1995). Recent studies have shown that individuals can make accurate predictions about others in the zero acquaintance conditions, even solely from photographs of their faces.

For example, Penton-Voak et al. (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 in individuals' faces is faster compared to the other Big Five traits (Borkenau et al., 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 is 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 et al. (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 et al. (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 casts 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). Moreover, recent studies show that several factors can affect the accuracy of inferring personality traits from faces (Todorov et al., 2015). For example, the gender of both perceiver (Hall et al., 2000; Herlitz & Lovén, 2013) and target (Olivola & Todorov, 2010; Poutvaara et al., 2009) are important factors. It was found that inferencing Big Five personality traits from female targets are more accurate than male targets (Cornetto & Nowak, 2006; Fong & Mar, 2015; but see Hu et al., 2017). It was also known that females are advantageous in recognizing facial affect (Hall et al., 2000; Hampson et al., 2006) and face memory (Herlitz & Lovén, 2013) that might lead them to be more successful compared to males. However, some studies show that social judgments from faces do not vary depending on the perceiver's gender (e.g., Pauker et al., 2009; Penton-Voak et al., 2007; Rule et al., 2008; Zebrowitz et al., 1993). Considering mixed results and potential effective factors 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 on 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 (Henrich et al., 2010). 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 et al., 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.

2. Study 1

2.1. Participants

We have recruited 160 US American participants via Amazon

Mechanical Turk. Participants were paid $0.30 for their participation.[1]

2.2. Materials

We used face images provided by the 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, 1985) 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; Oltmanns & Turkheimer, 2006; Paulhus et al., in press; Raskin & Terry, 1988) 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 et al., 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 Fig. 1.

2.3. 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.

Since the US exhibits a relative homogeneity across the regions in terms of WEIRDness and fulfill all characteristics of the WEIRD sample (Klein et al., 2018; Muthukrishna et al., 2020), we recruited participants from the US as a WEIRD culture. In addition, Amazon Mechanical Turk workers have a higher level of education than the general US population (Berinsky et al., 2012; Kang et al., 2014; Pew Research Center, 2016). Thus, we did not measure separately all determinants of WEIRDness (i.e., western, educated, industrialized, rich, and democratic) in the sample of the US.

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. The 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.

2.4. Results

We performed Pearson's chi-squared 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.

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.

When adjusted for multiple comparisons with a Bonferroni correction, taking $p = .003$ as the significance threshold, all results with an accuracy level significantly higher than 50% were still significant, except for the female – agreeableness category.

3. 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/?view_only=486271942ac444819963188c3096c6b3). We attached a copy of the questionnaire and analysis syntax to the pre-registration 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 $w = 0.17$ (which corresponds to this accuracy rate) and taking alpha as 0.05 and power as 0.80, we calculated that we needed a minimum of 272 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, 173 males, 7 not responded; $M_{age} = 37.58$, $SD = 11.83$). Study 2 was identical to Study 1, except for that participants also reported their age, sex, and ideology[3] (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.

3.1. Results

Similar to Study 1, we performed Pearson's chi-squared 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 faces with a higher extraversion level were 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.

When adjusted for multiple comparisons with a Bonferroni correction, taking $p = .003$ as the significance threshold, all results with an accuracy level significantly higher than 50% were still significant, except for male and female conscientiousness categories.

We also investigated whether participants' sex influenced the level

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

[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.

Big Five Personality Traits

| High | Low | High | Low |

Agreeableness

Conscientiousness

Extraversion

Openness

Neuroticism

Dark Triad Personality Traits

| High | Low | High | Low |

Narcissism

Machiavellianism

### Psychopathy
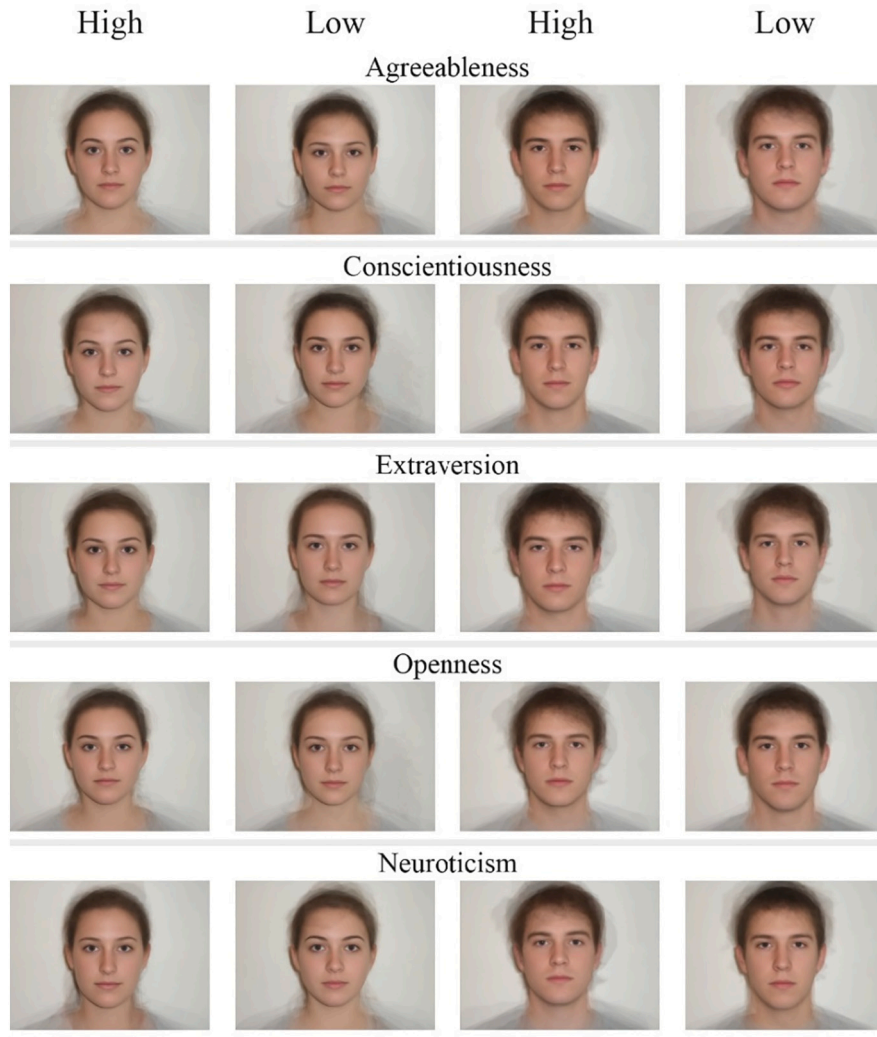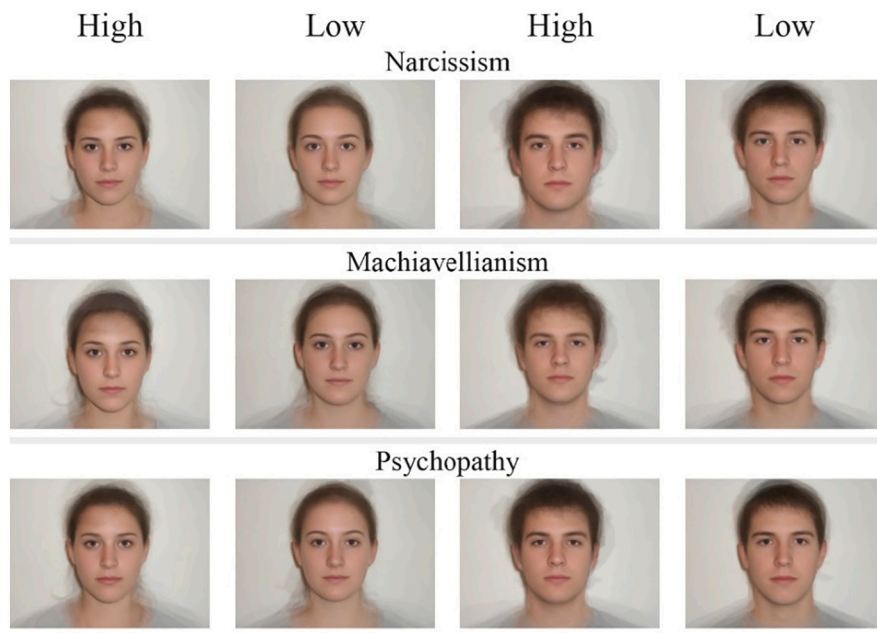
(caption on next page)

Fig. 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/.

of their accuracy (see Table 4). The difference between male and female participants with regard to their percent of correct responses was not significant for any category, except for the female participants were relatively more accurate to identify highly psychopathic male face. But considering that there was a total of 16 comparisons of accuracy levels (see "Sex difference" column in Table 4), that result also becomes nonsignificant after a Bonferroni correction, taking $p = .003$ as the significance threshold. Thus, results in general did not suggest a difference between male and female participants.

4. Study 3

In Study 3, we replicated Study 2 on a Turkish, non-WEIRD sample (Henrich et al., 2010). Study design and analysis plan were pre-registered prior to data collection (https://osf.io/hgwfy/?view_only=ef9dbf53851e4168bb35ef9dde4f5fb2). 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, they were eliminated. The resulting sample size was 402 (339 females; $M_{age} = 20.77$, $SD = 1.94$).

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 5.

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). When adjusted for multiple comparisons with a Bonferroni correction, taking $p = .003$ as the significance threshold, all results with an accuracy level significantly higher than 50% were still significant.

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	w
Agreeableness	**159**	**Female**	**58.49%**	**4.585**	**0.032**	**0.17**
	160	**Male**	**71.25%**	**28.900**	**< 0.001**	**0.43**
Conscientiousness	160	Female	52.50%	0.400	0.527	0.05
	160	Male	55.00%	1.600	0.206	0.10
Extraversion	**160**	**Female**	**71.88%**	**30.625**	**< 0.001**	**0.44**
	160	Male	41.25%	4.900	0.027	0.18
Neuroticism	160	Female	39.38%	7.225	0.007	0.21
	160	Male	43.13%	3.025	0.082	0.14
Openness	160	Female	42.50%	3.600	0.058	0.15
	160	Male	35.63%	13.225	< 0.001	0.29
Narcissism	**160**	**Female**	**62.50%**	**10.000**	**0.002**	**0.25**
	159	Male	55.97%	2.270	0.132	0.12
Psychopathy	**160**	**Female**	**64.38%**	**13.225**	**< 0.001**	**0.29**
	160	**Male**	**67.50%**	**19.600**	**< 0.001**	**0.35**
Machiavellianism	**159**	**Female**	**62.26%**	**9.566**	**0.002**	**0.25**
	160	**Male**	**60.00%**	**6.400**	**0.011**	**0.20**

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

Next, we combined the data from all studies to illustrate the overall results (see Table 6). When all data were merged, participants had an accuracy level that is significantly higher than 50% in detecting agreeableness (male and female), conscientiousness (male and female), extraversion (female), and all Dark Triad traits (male and female).

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 50% level.

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%), $\chi2(1) = 6.622$, $p = .010$. For the narcissism-male category, similarly, the Turkish participants (67.16%) were more successful than the US American, $\chi2(1) = 5.090$, $p = .024$. The other differences were not statistically significant. All findings regarding the differences between

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).[a]
[a]The definition of narcissism used here corresponds to the specific version of the trait (i.e., grandiose narcissism, not vulnerable; Ackerman et al., 2011) and the definition of psychopathy confounds the distinction between primary and secondary traits (i.e., more callousness/emotionless and more impulsivity/heightened negative emotionality; Levenson, Kiehl, & Fitzpatrick, 1995). However, to replicate Holtzman's (2011) findings, we used the same stimuli and definitions in this study.

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	w
Agreeableness	316	**Female**	**64.56%**	**26.785**	**< 0.001**	**0.29**
	316	**Male**	**70.57%**	**53.481**	**< 0.001**	**0.41**
Conscientiousness	318	**Female**	**56.29%**	**5.031**	**0.025**	**0.13**
	317	**Male**	**55.52%**	**3.864**	**0.049**	**0.11**
Extraversion	317	**Female**	**71.61%**	**59.208**	**< 0.001**	**0.43**
	316	Male	43.67%	5.063	0.024	0.13
Neuroticism	317	Female	38.49%	16.811	< 0.001	0.23
	316	Male	45.25%	2.848	0.091	0.10
Openness	317	Female	36.28%	23.877	< 0.001	0.27
	317	Male	33.12%	36.117	< 0.001	0.34
Narcissism	318	**Female**	**66.35%**	**34.013**	**< 0.001**	**0.33**
	316	**Male**	**61.71%**	**17.329**	**< 0.001**	**0.23**
Psychopathy	318	**Female**	**68.24%**	**42.314**	**< 0.001**	**0.36**
	316	**Male**	**69.30%**	**47.101**	**< 0.001**	**0.39**
Machiavellianism	316	**Female**	**66.46%**	**34.228**	**< 0.001**	**0.33**
	318	**Male**	**58.49%**	**9.170**	**0.002**	**0.17**

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

the US American and Turkish samples are available at https://osf.io/dbxe5/?view_only=2540de9ebdcf448cbf564efb1c721a43.

5. Discussion

Across the 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 (i.e., accuracy rates were significantly above the chance level); (2) the results were mixed about the

Table 5
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	w
Agreeableness	402	**Female**	**60.70%**	**18.398**	**< 0.001**	**0.21**
	402	**Male**	**65.92%**	**40.756**	**< 0.001**	**0.32**
Conscientiousness	402	Female	54.73%	3.592	0.058	0.09
	402	**Male**	**58.96%**	**12.896**	**< 0.001**	**0.18**
Extraversion	402	**Female**	**75.12%**	**101.502**	**< 0.001**	**0.50**
	402	Male	31.59%	54.477	< 0.001	0.37
Neuroticism	402	Female	41.29%	12.189	< 0.001	0.17
	402	Male	44.28%	5.264	0.022	0.11
Openness	402	Female	33.33%	44.667	< 0.001	0.33
	402	Male	25.87%	93.622	< 0.001	0.48
Narcissism	402	**Female**	**73.13%**	**86.060**	**< 0.001**	**0.46**
	402	**Male**	**67.16%**	**47.373**	**< 0.001**	**0.34**
Psychopathy	402	**Female**	**72.64%**	**82.398**	**< 0.001**	**0.45**
	402	**Male**	**74.13%**	**93.622**	**< 0.001**	**0.48**
Machiavellianism	402	**Female**	**68.16%**	**53.025**	**< 0.001**	**0.36**
	402	**Male**	**63.43%**	**29.015**	**< 0.001**	**0.27**

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

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 (i.e., above chance level) by the participants.

Table 4
Accuracy in judgments of the Big Five and the Dark Triad traits in Study 2, broken down by sex of the participants.

	Face sex	Sex of the participant	N	Percentage of correct responses	$\chi^2(1)$	p-value	w	Sex difference
Agreeableness	**Female**	**Female**	**142**	**64.08%**	**11.268**	**< 0.001**	0.28	$\chi^2(1) = 0.015, p = .903$
	Female	**Male**	**173**	**64.74%**	**15.035**	**< 0.001**	0.29	
	Male	**Female**	**142**	**73.24%**	**30.676**	**< 0.001**	0.46	$\chi^2(1) = 0.901, p = .342$
	Male	**Male**	**173**	**68.21%**	**22.942**	**< 0.001**	0.36	
Conscientiousness	Female	Female	142	50.70%	0.028	0.867	0.01	$\chi^2(1) = 3.534, p = .060$
	Female	**Male**	**173**	**61.27%**	**8.792**	**0.003**	0.23	
	Male	Female	142	56.34%	2.282	0.131	0.13	$\chi^2(1) = 0.064, p = .800$
	Male	Male	173	54.91%	1.671	0.196	**0.10**	
Extraversion	**Female**	**Female**	**142**	**74.65%**	**34.507**	**< 0.001**	0.49	$\chi^2(1) = 1.073, p = .300$
	Female	**Male**	**173**	**69.36%**	**25.948**	**< 0.001**	0.39	
	Male	Female	142	38.73%	7.211	0.007	0.23	$\chi^2(1) = 2.702, p = .100$
	Male	Male	173	47.98%	0.282	0.595	**0.04**	
Neuroticism	Female	Female	142	39.44%	6.338	0.012	0.21	$\chi^2(1) = 0.115, p = .735$
	Female	Male	173	37.57%	10.688	0.001	**0.25**	
	Male	Female	142	43.66%	2.282	0.131	0.13	$\chi^2(1) = 0.313, p = .576$
	Male	Male	173	46.82%	0.699	0.403	**0.06**	
Openness	Female	Female	142	35.21%	12.423	< 0.001	0.30	$\chi^2(1) = 0.107, p = .744$
	Female	Male	173	36.99%	11.705	< 0.001	**0.26**	
	Male	Female	142	30.28%	22.085	< 0.001	0.39	$\chi^2(1) = 0.872, p = .350$
	Male	Male	173	35.26%	15.035	< 0.001	0.29	
Narcissism	**Female**	**Female**	**142**	**66.90%**	**16.225**	**< 0.001**	0.34	$\chi^2(1) = 0.006, p = .936$
	Female	**Male**	**173**	**66.47%**	**18.780**	**< 0.001**	0.33	
	Male	**Female**	**142**	**60.56%**	**6.338**	**0.012**	0.21	$\chi^2(1) = 0.115, p = .735$
	Male	**Male**	**173**	**62.43%**	**10.688**	**0.001**	0.25	
Psychopathy	**Female**	**Female**	**142**	**72.53%**	**28.845**	**< 0.001**	0.45	$\chi^2(1) = 2.747, p = .097$
	Female	**Male**	**173**	**63.74%**	**15.035**	**< 0.001**	0.27	
	Male	**Female**	**142**	**77.46%**	**42.845**	**< 0.001**	0.55	$\chi^2(1) = 7.661, p = .006$
	Male	**Male**	**173**	**63.01%**	**11.705**	**< 0.001**	0.26	
Machiavellianism	**Female**	**Female**	**142**	**67.61%**	**17.606**	**< 0.001**	0.35	$\chi^2(1) = 0.102, p = .749$
	Female	**Male**	**173**	**65.90%**	**17.486**	**< 0.001**	0.32	
	Male	Female	142	57.75%	3.408	0.065	0.16	$\chi^2(1) = 0.047, p = .829$
	Male	**Male**	**173**	**58.96%**	**5.555**	**0.018**	0.18	

Note. Lines written in boldface show accurate trait predictions for which the proportion of correct responses was significantly ($p < .05$) higher than %50. The differences between male and female participants with regard to their percent of accurate responses are reported in the "Sex difference" column.

Table 6
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	W
Agreeableness	**877**	**Female**	**61.69%**	**47.919**	**< 0.001**	**0.23**
	878	**Male**	**68.56%**	**121.043**	**< 0.001**	**0.37**
Conscientiousness	**880**	**Female**	**54.89%**	**8.405**	**0.004**	**0.10**
	879	**Male**	**57.00%**	**17.212**	**< 0.001**	**0.14**
Extraversion	**879**	**Female**	**73.27%**	**190.308**	**< 0.001**	**0.47**
	878	Male	37.70%	53.139	< 0.001	0.25
Neuroticism	879	Female	39.93%	35.642	< 0.001	0.20
	878	Male	44.42%	10.938	0.001	0.11
Openness	879	Female	36.06%	68.288	< 0.001	0.28
	879	Male	30.26%	136.984	< 0.001	0.39
Narcissism	**880**	**Female**	**68.75%**	**123.750**	**< 0.001**	**0.38**
	877	**Male**	**63.17%**	**60.485**	**< 0.001**	**0.26**
Psychopathy	**880**	**Female**	**69.55%**	**134.473**	**< 0.001**	**0.39**
	878	**Male**	**71.18%**	**157.613**	**< 0.001**	**0.42**
Machiavellianism	**877**	**Female**	**66.48%**	**95.235**	**< 0.001**	**0.33**
	880	**Male**	**61.02%**	**42.768**	**< 0.001**	**0.22**

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

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 findings (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. In addition, 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. Moreover, unlike previous findings (e.g., Olivola & Todorov, 2010), we failed to find any effect of the perceiver's gender on trait inference.

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 et al., 2014). Therefore, during face-to-face contact, the first impression of others can be decisive (Carney et al., 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 et al., 2005). Extravert individuals are also more likely to report positive emotions, gregariousness, and assertiveness (McCrae & Costa, 2008), and parental nurturance (Metsäpelto & Pulkkinen, 2003). Moreover, the extraversion dimension can be easily determined among other Big Five traits especially in interpersonal behaviors (Borkenau et al., 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 et al., 2004; Naumann et al., 2009). Therefore, detecting extraversion may be facilitating preference for such faces and corresponds 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 et al., 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. In addition to the evolutionary significance of these traits, an alternative explanation can be proposed to explain the mixed findings in the Big Five Traits. Since Big Five personality traits are much broader than the Dark Triad traits in terms of specific characteristics, the Big Five traits may imply more diverse facial expressions and thus may complicate accurate trait inference from faces.

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 et al., 2008), workspace and bedrooms (Gosling et al., 2002), the 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 et al., 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.

Research on inferences personality traits from faces often focuses on the Big Five, Dark Triad, and socially taking attention features such as trustworthiness, dominance, and attractiveness (Todorov et al., 2015). However, recent studies showed that Honesty-Humility, which refers to the tendency to be fair, frank, modest, and greed avoidance is cross-culturally validated (Ashton et al., 2004; Lee & Ashton, 2008). The six-factor model of HEXACO (Lee & Ashton, 2004), in which Honesty-Humility is included in addition to Big Five traits, explain important variance compared to Big Five and closely and negatively linked to Dark Triad personality traits (Aghababaei et al., 2016; Book et al., 2015; Lee & Ashton, 2014, 2018). Thus, further studies should both create stimuli sets for the Honesty-Humility trait and test whether it can be inferred from face photographs as well.

Future research investigating the facial cues of personality are also recommended to take into account further details (i.e., ecological niche) 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 the 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 future research should make use of more carefully designed materials to tap into the question of visibility of personality in the face.

The results of the current study should be seen in the light of some potential limitations. First, the results should be replicated using nationally representative samples regarding the education level of the participants, as the sample of Study 3 in the current research consisted of undergraduate students while Study 1 and 3 did not provide information on the education level of the participants. Second, to replicate the previous studies, we used the same instructions (i.e., presented definitions of personality traits) and face photographs from previous studies. However, these definitions that were taken from scientific texts may not be easy to understand by the general public. Further research should use an alternative, possibly easier-to-read definitions, and explain complicated concepts in familiar words. Third, we used the composite face images created by Holtzman (2011), but one limitation of these images is that all composite faces look like they belong to a Caucasian individual. Future research should use more diverse sets of images to investigate whether any racial bias occurs. Furthermore, the effect sizes are generally low-to-moderate in the literature, including the current research. In addition, although we recruited samples from psychologically two distant cultures (Muthukrishna et al., 2020), the same hypotheses should be tested in other cultures as well. Lastly, an important limitation of this study is interpreting results at chance level. Findings that show the accuracy of inferring personality traits from faces should be evaluated considering that success does not mean 100% accuracy, but an accuracy level greater than chance alone (i.e., > 50%).

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.

CRediT authorship contribution statement

Sinan Alper: Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing. **Fatih Bayrak:** Conceptualization, Resources, Writing - original draft, Writing - review & editing. **Onurcan Yilmaz:** Conceptualization, Writing - original draft, Writing - review & editing.

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