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Reader in face-reading: viewer's empathy and sensitivity to disgust impacts the first impressions of anomalous faces

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Abstract

People "read" others' inner traits based on their faces. They attribute positive traits to those who are more attractive (beauty-is-good) and negative to those with facial anomalies (anomalous-is-bad). But how do the "reader's" traits impact this process? Do more empathetic "readers" and those sensitive to disgust judge faces differently? We tested the hypothesis that viewers' psychological attributes affect judgments of people with facial scars and palsies. We predicted that participants who are less empathic and more sensitive to pathogen disgust would judge more harshly the warmth and competence of people with anomalous faces and also dehumanize them. We conducted an online study with 1493 participants, who assessed 31 psychological traits of anomalous faces presented in photographs. Using principal component analysis, we found that empathic concern did not affect impressions of warmth and dehumanization but did matter for competence. More empathetic participants saw anomalous faces as more competent. Sensitivity to pathogen disgust did not affect warmth and dehumanization but did affect competence. Higher sensitivity was related to higher competence assessments. Additionally, those with higher personal distress judged anomalous faces as less warm and competent and dehumanized them more. Those with higher sensitivity to sexual disgust judged faces as less warm, more competent, and dehumanized them more. We conclude that the question "who the reader is?" is crucial when studying "face-reading".

Keywords Face perception · Empathy · Sensitivity to disgust · Face-reading · Anomalous face

"Imago animi vultus est"

Latin phase

Introduction

This old Latin quote underlines the belief that one can "read" a person's traits from facial expressions, as the face is the picture of the soul. Empirical studies confirm that a glance is enough to infer psychological attributes of others, a process called "face-reading" (Zebrowitz, 2017). The "reader" cares if the face is attractive (Little et al., 2011; Olson & Marshuetz, 2005). Those attractive are considered to have positive character traits, such as intelligence, trustworthiness, and hard work (Jamrozik et al., 2019). Such inferences contribute to creating stereotypes. For instance, an anomalous-is-bad stereotype, which is the topic of our study, posits that people with visible facial differences are less moral (Jamrozik et al., 2019; Workman et al., 2022). The anomalous-is-bad is analogous to the beauty-is-good

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stereotype (Cui et al., 2019; Dion et al., 1972; Klebl et al., 2021; Villavisanis et al., 2022). Such impressions illustrate the halo effect (Eagly et al., 1991), in which one positive trait leads perceivers to judge other attributes favorably, or its opposite—the horn effect (Thorndike, 1920; Zeigler-Hill et al., 2021)—where a single negative perception spurs generally unfavorable evaluations.

Theoretically, these stereotypes can be partially explained by the "face overgeneralization" effect (Zebrowitz, 2017; Zebrowitz & Montepare, 2008). Humans have evolved to rapidly infer traits from facial cues—an adaptation that historically helped identify potential allies, threats, or mates. However, these quick judgments can overextend to individuals whose faces deviate from typical appearance, fueling stereotypes about their character. In other words, when a face appears anomalous, perceivers might mistakenly attribute negative traits to it because people are cognitively primed to be wary of cues that once signaled danger or poor health. Although such rapid inferences once served protective or affiliative functions, they now contribute to unwarranted stigmas in modern social environments.

Such stereotypes are not only about "reading". For instance, the anomalous-is-bad stereotype expresses itself not only in attitudes but also in dispositions, neural responses, and behavior (Workman et al., 2021). First impressions from faces have various consequences (Olivola et al., 2014). They bear on financial success (Duarte et al., 2012; Rule & Ambady, 2011), judicial decisions (Jaeger et al., 2020; Wilson & Rule, 2015), or being victims of violence (Haslam & Murphy, 2020). People with facial differences are incorrectly seen to have less desirable personality traits (e.g., less emotional stability), internal (e.g., less intelligence), and social attributes (e.g., less trustworthiness) (Jamrozik et al., 2019). The extent to which this effect depends on the viewer's traits is unclear. Here, we examined how the level of "reader's" empathy and sensitivity to disgust impacts their assessment of faces with anomalies, i.e., scars and palsies.

"Reading" from anomalous faces

People "read" faces for various psychological traits (Todorov et al., 2012), like trustworthiness (Rule et al., 2013), warmth (Dion et al., 1972; Eagly et al., 1991), dominance (Batres et al., 2015), aggression (Carré & McCormick, 2008), competence (Dion et al., 1972; Eagly et al., 1991; Sussman et al., 2013), extraversion (Borkenau et al., 2009), or even their mental health (Fowler et al., 2009). People also "read" atypical faces. They even judge others as having the traits of the animals their faces resemble (Zebrowitz, 2006; Zebrowitz & Collins, 1997). Anomalous faces often activate an "anomalous-is-bad" stereotype, prompting observers to assume that people with visible facial differences lack key positive qualities. These assumptions disproportionately affect perceptions of warmth and competence—two core dimensions people use to categorize others (Jamrozik et al., 2019; Paruzel-Czachura et al., 2024; Workman et al., 2021, 2022; Zebrowitz et al., 2003). Warmth (also termed communion or morality; Abele & Wojciszke, 2013) reflects perceived friendliness, empathy, and trustworthiness (Abele & Brack, 2013; Brambilla et al., 2021). In our study, we capture warmth with traits such as moral, helpful, good-natured, and trustworthy (Jenkins et al., 2018). Competence (often called agency or ability; Abele & Wojciszke, 2013; Fiske, 2018) involves perceived skill, intelligence, and goal-oriented efficacy (Abele & Brack, 2013; Brambilla et al., 2021). Accordingly, we operationalize competence using items like efficient, skilled, confident, and clever (Jenkins et al., 2018). Perceiving individuals with facial anomalies as lacking warmth or competence can escalate into dehumanization (Kuljian & Hohman, 2022).

Dehumanization involves denying others the traits that are considered fundamental to being human—such as emotional depth, moral agency, or rational thought (Haslam et al., 2012; Harris & Fiske, 2011). This process typically occurs in two distinct forms (Haslam, 2006; Haslam & Murphy, 2020). Mechanistic dehumanization likens people to objects or machines, stripping them of individuality, emotional experience, and interpersonal warmth. Animalistic dehumanization, by contrast, involves likening people to nonhuman animals, denying them civility, intelligence, or moral refinement. Both forms can contribute to social exclusion, stigmatization, or even violence—particularly when applied to individuals who deviate from normative appearance standards. Research suggests that people with facial anomalies are especially vulnerable to such perceptions and are more likely to be seen as less human than those with typical appearances (Paruzel-Czachura et al., 2024).

The most frequently studied anomaly in "face-reading" research is the facial scar, which is also among the most common facial anomalies in the general population (Gunnarsson, 2022; Lawrence et al., 2012; Zapatero et al., 2022). We also included facial palsy—another relatively prevalent condition (Fuller & Morgan, 2016)—due to its distinct etiology and potential for divergent interpretation. While facial scars typically suggest external causes (e.g., injury), facial palsies often imply internal or biological dysfunction (e.g., nerve damage), which may activate pathogen-avoidance mechanisms in perceivers (Tybur et al., 2009). Thus, scars may elicit moral or aesthetic judgments, whereas facial palsy may provoke greater health-related concern. By including both types of anomalies, we aim to examine whether specific visual cues evoke distinct forms of bias, or

whether one anomaly exacerbates negative reactions more than the other.

Does the "reader" matter??

Despite abundant research underscoring the importance of "face-reading," comparatively little is known about how the "reader" contributes to the anomalous-is-bad stereotype. People vary substantially in their ability to recognize faces, attend to subtle facial expressions, and notice fine-grained structural differences (Bruce et al., 2018; Wilhelm et al., 2010; Yovel et al., 2014). Personality factors such as extraversion and neuroticism also influence how facial cues are processed (Fox & Zougkou, 2012; Kafetsios & Hess, 2022). Research on facial attractiveness further shows that individual traits can modulate preferences (e.g., high-sensation-seeking men show stronger preferences for highly feminine faces; Jones et al., 2007), and agreeable individuals may favor attractive interaction partners in economic games (Voit et al., 2021). Building on this work, we propose that empathy and disgust sensitivity are key dimensions shaping responses to anomalous faces.

Empathy has been linked to enhanced accuracy in "reading" others' emotional expressions (Fox & Zougkou, 2012) and greater willingness to engage in prosocial behaviors (Davis, 1996). Consequently, individuals high in empathy might respond more sympathetically toward those with visible facial anomalies, mitigating negative judgments. In contrast, disgust sensitivity—particularly pathogen disgust—operates as an adaptive mechanism that helps individuals avoid potential sources of contamination (Tybur et al., 2009). This heightened vigilance can become overgeneralized when encountering atypical facial features (Zebrowitz & Montepare, 2008), fueling aversive or stigmatizing reactions (Ryan et al., 2012; Shanmugarajah et al., 2012). Indeed, people with high disgust sensitivity judge unattractive or anomalous targets more harshly (He et al., 2022). Echoing this observation, our prior work found that empathic concern and disgust sensitivity jointly modulated amygdala responses to anomalous faces (Workman et al., 2021), suggesting that these traits play a central role in how observers construe facial differences.

From a functional perspective, empathy and disgust represent core motivational systems—affiliative versus protective—that shape our responses to social stimuli (Tybur et al., 2009). Empathy facilitates care and connection, while disgust motivates avoidance of potential threats (e.g., disease). These emotional tendencies help explain why certain individuals respond negatively to visible anomalies, interpreting them as threats, whereas others may react with concern or compassion. Thus, these constructs are theoretically grounded in their role as key drivers of stereotype formation,.

Empathy and sensitivity to disgust

Empathy can take different forms. These include empathic concern, personal distress, and perspective taking (Davis, 1983). The empathic concern involves compassion, concern for someone suffering, and a desire to alleviate their distress (Davis, 1983). It motivates helping, comforting, or supporting others in need (Zaki, 2018). More empathetic people are more likely to help selflessly, even when doing so involves personal costs (Davis, 1996). Empathic concern is thought to be distinct from other forms of empathy, such as emotional empathy (feeling the same emotions as someone else) and cognitive empathy (understanding someone else's perspective) (Decety & Jackson, 2004). While emotional and cognitive empathy contribute to prosocial behavior, empathic concern is the most direct motivator for altruistic acts (Batson, 2011; Zaki, 2018). Empathic concern is distinct from other forms of empathy. Personal distress is the self-focused emotional reaction to the suffering of others, often characterized by feelings of discomfort, anxiety, or distress. It is an aversive emotional response that occurs in response to witnessing another's pain. Perspective-taking is the cognitive aspect of empathy, involving understanding and considering another person's point of view, thoughts, and feelings (Davis, 1996).

Disgust can also take different forms. Pathogen disgust relates to disgust towards carriers of disease or illness. It represents an aversion towards potentially contaminated things, such as bodily fluids, feces, or rotting food (Tybur et al., 2009). It is associated with behaviors that reduce the risk of infection, such as handwashing (Murray & Schaller, 2016). Individuals with higher pathogen disgust tend to be more anxious about germs and contamination and more sensitive to smells, tastes, and textures associated with potential pathogens (Tybur et al., 2009). Higher pathogen disgust is related to negative attitudes towards outgroups, such as homeless individuals, drug users, or people from different cultural backgrounds, who may be perceived as dirty (Tybur et al., 2009). Pathogen disgust is distinct from other forms of disgust. While pathogen disgust motivates the avoidance of infectious microorganisms, moral disgust motivates the avoidance of social norm violators, like cheaters, and sexual disgust motivates the avoidance of sexual situations that would jeopardize one's reproductive success, like incest (Tybur et al., 2009).

We propose that empathy and disgust sensitivity manifest differently depending on the type of facial anomaly.

Because scars are typically viewed as externally caused (e.g., from accidents or injuries), individuals high in empathy may respond more sympathetically, seeing the person as a "victim of circumstance." In contrast, facial palsies—often perceived as reflecting an internal or biological issue—can activate disease or pathogen concerns, particularly among those with elevated disgust sensitivity (Workman et al., 2021; Tybur et al., 2009). This heightened vigilance might lead to avoidance tendencies or more negative impressions, as observers misinterpret internal anomalies as threatening. By examining both scars and palsies, we can determine whether empathy and disgust exert uniformly strong influences across different visible differences or if certain anomalies uniquely amplify one response over the other. This framework not only refines our understanding of "face-reading" but also underscores the functional role of these core motivational systems in shaping social judgments.

The current research

We aimed to study how viewers' empathy and sensitivity to disgust influence their "face-reading" of anomalous faces. We focused on empathic concern and sensitivity to pathogen disgust as the traits we predicted would have the greatest impact on the "face-reading" of anomalous faces. We also measured the reader's perspective taking, personal distress (Davis, 1996), and moral and sexual disgust (Tybur et al., 2009). This could help us understand how diverse empathy and disgust dimensions could affect "face-reading". We preregistered hypotheses about empathic concern and pathogen disgust and treated other variables as exploratory.

Our study has two additional strengths. First, we tested two types of anomalous faces: with scars and palsies, contrary to past research, which focused only on scars as the example of anomaly (Workman et al., 2022), or a diverse set of anomalous faces (Jamrozik et al., 2019). This way, we could differentiate the possible impact of the type of anomaly on face perception. It is relevant as different facial anomalies may trigger different judgments. We used the most common anomaly– scar (Gunnarsson, 2022; Lawrence et al., 2012; Zapatero et al., 2022) and the common anomaly of palsies (Fuller & Morgan, 2016). Second, we used tightly controlled stimuli (i.e., photographs of real people before and after plastic surgery) (Workman & Chatterjee, 2021), contrary to past research that used synthetic faces generated by a computer. Using photographs instead of generated faces has advantages (see also Cook & Over, 2021). Our facial stimuli include diverse races, ages, and genders to avoid biases based on demographic features (Chatterjee, 2021).

Preregistered hypotheses

We hypothesized that viewers' individual psychological dispositions shape how strongly they endorse the anomalous-is-bad stereotype. Specifically, we predicted that lower empathic concern and higher pathogen disgust sensitivity would be associated with harsher judgments of warmth and competence for faces with visible differences and a greater propensity to dehumanize them. We treated other measures as exploratory.

Method

The Institutional Review Board at the University of Pennsylvania reviewed and approved the study. This article is part of a bigger project on the perception of anomalous faces (Paruzel-Czachura et al., 2024).

Transparency and openness

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study (see the main publication: Paruzel-Czachura et al., 2024), and the study follows JARS (Appelbaum et al., 2018). All data, analysis code, and research materials are available at https://osf.io/kf654/?view_only=None. Data were analyzed using R, version 4.0.0. This study was preregistered at https://osf.io/m56wb?view_only=None.

Participants & procedure

We preregistered recruiting $N = 1500$ participants, following the effect sizes from Jamrozik et al. (2019). One hundred and two responses per trait would provide high reliability (Cronbach's $\alpha > 0.8$). However, we targeted 120 responses, as we suspected some participants would be excluded.

Participants must be at least 18 years old and from the United States. We recruited them via Amazon's Mechanical Turk platform. To join the study, they could not have any significant facial anomalies. The survey took about 30 min. Participants were given about $4. As preregistered, we excluded participants who failed more than 2 out of 3 checks. In the end, participants assessed the quality of their data, and we excluded those who declared their data was not high-quality (Curran, 2016).

Out of the 1493 individuals who initially participated, our final sample size was 1306 after applying our predefined exclusion criteria. This final group comprised 446 women, 854 men, one identifying as "other," one as nonbinary, and four participants who preferred not to disclose their gender. The participants' ages averaged 36.51 years ($SD = 10.23$),

ranging from 20 to 84. The mean education level was 14.82 years (*SD* = 2.97), spanning 1 to 26 years.

Regarding racial and ethnic backgrounds, 1086 participants identified as white, 100 as African-American, 51 as Asian, 27 as American Indian, one as Pacific Islander, 25 as multiracial, six selected "other," and 10 chose not to disclose their race. Regarding Hispanic or Latino identity, 275 participants indicated they were, while 1019 said they were not, and 12 decided not to answer.

For sexual orientation, 957 participants identified as heterosexual, 38 as homosexual, 285 as bisexual, 9 as pansexual, 3 as asexual, 2 chose "other," and 12 preferred not to disclose. Participants' political views on social issues averaged 4.42 (*SD* = 1.99) on a scale from 1 (*very liberal*) to 7 (*very conservative*). For economic issues, the average was 4.61 (*SD* = 1.91) on the same scale.

Upon giving consent and receiving instructions, participants began an online survey on the Qualtrics platform. First, they evaluated psychological traits, attractiveness, and age. Next, they fill out additional questionnaires about empathy and sensitivity to disgust. At the end, they were asked about their sociodemographic information.

Measures

Stimuli. We sourced the photographic stimuli from the open-access ChatLab Facial Anomaly Database (Workman & Chatterjee, 2021). Of the total stimuli, 78.01% were labeled as White, 11.87% as Latinx, 5.25% as Black, and 4.87% as Asian. Regarding sex, 70.42% of the faces were female, and 29.58% were male. Half of the images featured a facial palsy (50.05%), while the other half featured a facial scar (49.95%). Each anomalous face had a corresponding digitally corrected version, and participants were randomly assigned to view either the anomalous or the corrected version of a given face. For further transparency, we provide a complete list of all stimuli, including face identifiers and participant assignments, in the 'Stimuli' file available on OSF (see Fig. 1).

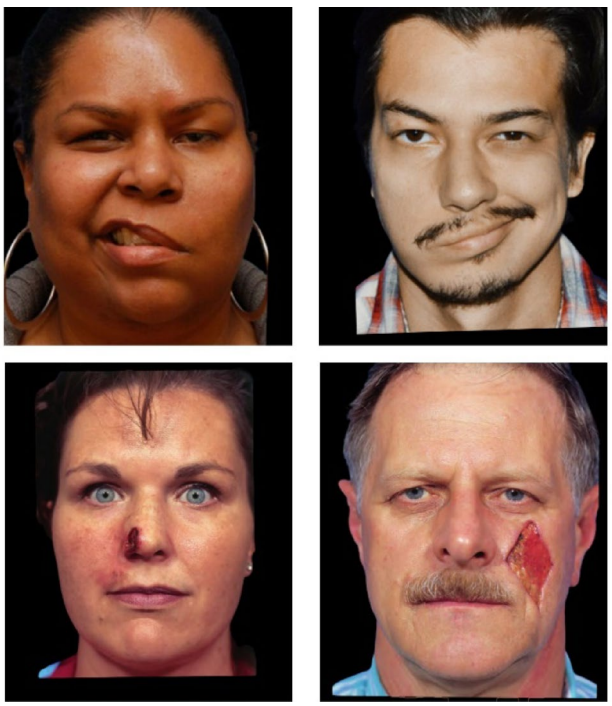

Fig. 1 Examples of Photographs from the ChatLab Database sourced from Workman and Chatterjee (2021). The top row illustrates facial palsies, while the bottom represents facial scars

Rating Faces. We adapted the overall task structure from Jamrozik et al. (2019) and Workman et al. (2021). Each participant completed ten trials; in each trial, they viewed a photograph of a face that was either anomalous or surgically corrected. We focused solely on participants' responses to the pre-surgical (anomalous) faces for the present study. Each face was rated on the following 31 traits: capable of self-control, capable of rage, efficient, capable of fear, knowledgeable about others' feelings, trustworthy, creative, capable of planning, capable of remembering things, skilled, good-natured, tolerant, understanding, capable of hunger, sincere, communicative, capable of pride, friendly, capable of pain, moral, capable of desire, confident, capable of joy, capable of embarrassment, capable of telling right from wrong, helpful, capable of foresight, clever, intelligent, capable of pleasure, and capable of remembering things.

Warmth & Competence. Participants were asked to evaluate the warmth traits of individuals in the photographs, such as being friendly, understanding of others, trustworthy, good-natured, sincere, tolerant, moral, and helpful. Additionally, they assessed competence traits, including being confident, clever, capable, creative, skilled, efficient, foresighted, and intelligent (Jenkins et al., 2018). Participants assessed possessing every trait on a 100-point scale from 1 (*not at all* [trait]) to 100 (*extremely* [trait]). We conducted a principal components analysis with varimax rotation on the ratings of all traits (Jenkins et al., 2018). Thanks to this approach, we calculated warmth and competence scores for each face. See the code at OSF.

Attractiveness & Age. Participants assessed facial attractiveness on a scale from 1 (*not at all attractive*) to 100 (*extremely attractive*) and how old they thought the person in the photograph was. As this was not our aim here, we do not report results on these variables. See OSF and main study for details (Paruzel-Czachura et al., 2024).

Dehumanization

Animalistic. We averaged the reverse-scored ratings related to moral sensibility (telling right from wrong, good-naturedness, trustworthiness, morality) and rationality/logic

(cleverness, planning, intelligence, self-control) (Haslam, 2006). Again, study participants assessed if the person in the photograph possesses such a trait on a 100-point scale from 1 (*not at all* [trait]) to 100 (*extremely* [trait]).

Mechanistic. We averaged the reverse-scored ratings related to emotional responsiveness (pride, knowing others' feelings, joy, embarrassment) and interpersonal warmth (helpfulness, sincerity, tolerance, friendliness) (Haslam, 2006). Again, study participants assessed if the person in the photograph possesses such a trait on a 100-point scale from 1 (*not at all* [trait]) to 100 (*extremely* [trait]).

Empathy. We used the Interpersonal Reactivity Index (Davis, 1983) to assess trait empathy. The scale contains four seven-item subscales, each tapping a separate facet of empathy. We excluded the *fantasy* subscale as it is unrelated to the studied topic. The *empathic concern* scale assesses the tendency to feel sympathy and compassion for unfortunate others (e.g., "I often have tender, concerned feelings for people less fortunate than me"). The *perspective-taking* scale measures the tendency to spontaneously adopt the psychological point of view of others in everyday life (e.g., "I sometimes try to understand my friends better by imagining how things look from their perspective"). The *personal distress* scale taps the tendency to experience distress and discomfort in response to distress in others (e.g., "Being in a tense emotional situation scares me"). Ratings were made along a 5-point scale ranging from 1—*does NOT describe me well* to 5—*describes me very well*. Higher scores indicate higher empathy. The Cronbach's alpha for empathic concern was 0.595 [*CI*: 0.559–0.629], for perspective taking 0.636 [*CI*: 0.604–0.666], and for personal distress 0.743 [*CI*: 0.722–0.763].

Disgust. We used the Three Domains of Disgust scale (Tybur et al., 2009) to assess sensitivity to different kinds of disgust. This is a 21-item self-report measure of disgust in three domains: *pathogen disgust* (e.g., "Stepping on dog poop"), *moral disgust* (e.g., "Deceiving a friend"), and *sexual disgust* (e.g., "Hearing two strangers having sex"). Ratings were made along a 7-point scale ranging from 0—*not at all disgusting* to 6—*extremely disgusting*. Higher scores indicate a stronger sensitivity to disgust. The Cronbach's alpha for pathogen disgust was 0.878 [*CI*: 0.868–0.888], for moral disgust 0.886 [CI: 0.876–0.895], and for sexual disgust 0.904 [*CI*: 0.896–0.911].

Demographics. We asked participants about their age, gender, sexual orientation, education, and political views on social and economic issues.

Preregistered analysis plan

We performed a principal components analysis on the traits related to warmth and competence, extracting up to 10 factors with Varimax rotation using the "psych" package in R. Because our theoretical framework did not anticipate correlations among factors and we aimed for a simpler, more distinct factor structure, we employed a Varimax (orthogonal) rotation. Varimax maximizes the variance of factor loadings, enhancing interpretability by aligning each item strongly with one factor and yielding minimal overlap across components. This approach was also consistent with common practices in research examining trait dimensions such as warmth and competence.

We had preregistered our intention to use linear mixed-effects models, including random intercepts for participants and faces. Using Satterthwaite's approximation, the lmerTest package (Kuznetsova et al., 2017) was employed to derive *p* values for the parameter estimates. For comparing models, we calculated null models and evaluated the Akaike information criterion (AIC) values, choosing the model with the superior AIC for its improved estimation of out-of-sample prediction error.

Results

In every analysis, the impact of individual differences (different forms of empathy and other forms of disgust) in inferences (warmth, competence, forms of dehumanization) about anomalous faces, linear mixed models were constructed with the inferences as the dependent variable and individual differences and type of anomaly (scars vs. palsies) as fixed factors. Random intercepts for face stimulus and participants were modeled. We used separate models for each empathy and disgust subscale to maintain clarity of interpretation, avoid issues with collinearity, and accurately capture the unique contribution of each subscale on face perception. First, we present how individual differences in empathy impact face assessment. Then, we focus on sensitivity to disgust. To explore the nature of significant interactions between facial anomaly type and empathy or sensitivity to disgust dimensions, we conducted simple slopes analyses using the emmeans package in R. For each significant interaction identified after Bonferroni correction, we estimated the difference in outcome (e.g., competence, dehumanization) between anomalous face types (palsy vs. scar) at ± 1 standard deviation from the mean of the moderator (e.g., empathy subscales: empathic concern, personal distress, and perspective taking). These slopes clarify how the relationship between anomaly type and social perception varies as a function of individual differences in empathy or sensitivity to disgust.

Table 1 Results for empathy and warmth

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Empathic Concern	−2.606e-01	1.224e-01	−2.129 (1.581e+03)	0.034	0.134
Anomaly Types	−3.800e-01	1.670e-01	−2.276 (1.996e+03)	0.023	0.092
Emphatic Concern * Anomaly Types	8.484e-02	4.128e-02	2.056 (1.341e+04)	0.040	0.159
Perspective Taking	7.951e-02	1.216e-01	0.654 (1.579e+03)	0.513	–
Anomaly Types	−2.408e-01	1.688e-01	−1.427 (2.075e+03)	0.154	–
Perspective Taking * Anomaly Types	4.455e-02	4.092e-02	1.089 (1.340e+04)	. 276	–
Personal Distress	−4.763e-01	1.023e-01	−4.655 (1.580e+03)	0.001	0.001
Anomaly Types	−3.143e-01	1.440e-01	−283 (1.164e+03)	0.029	0.117
Personal Distress * Anomaly Types	6.833e-02	3.471e-02	1.968 (1.341e+04)	0.049	0.196

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

Table 2 Results for empathy and competence

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Emphatic Concern	5.544e-01	4.822e-02	11.496 (1.607e+03)	<0.001	<0.001
Anomaly Types	−2.599e-01	7.137e-02	−3.642 (7.137e-02)	<0.001	0.001
Emphatic Concern * Anomaly Types	5.554e-02	1.842e-02	3.016 (1.344e+04)	0.002	0.010
Perspective Taking	2.698e-01	4.965e-02	5.433 (1.596e+03)	0.001	0.001
Anomaly Types	−1.082e-01	7.223e-02	−1.497 (3.698e+03)	0.134	–
Perspective Taking * Anomaly Types	1.240e-02	1.826e-02	0.679 (1.340e+04)	0.497	–
Personal Distress	5.902e-01	3.924e-02	15.039 (1.612e+03)	<0.001	<0.001
Anomaly Types	−3.019e-01	6.055e-02	−4.986 (2.072e+03)	0.001	0.001
Personal Distress * Anomaly Types	6.945e-02	1.548e-02	4.487 (1.345e+04)	0.001	0.001

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

Do individual differences in empathy impact assessments of warmth??

Empathic concern (Figure S1) and perspective-taking (Figure S2) did not affect "reading" warmth. The degree of personal distress (Table 1) viewers endorsed affected warmth "reading". The lower the personal distress,[1] the higher the warmth assessments (Figure S3). We observed no differences between anomalies.

Do individual differences in empathy impact assessments of competence??

Participants with higher empathic concern (Figure S4),[2] perspective taking (Figure S5),[3] and personal distress (Figure S6)[4] were more likely to find anomalous faces as more competent (Table 2). Faces with palsies were seen as more competent than faces with scars. To decompose significant interactions, we probed the simple effects of facial anomaly type (palsy vs. scar) across low (−1 SD), mean, and high (+1 SD) levels of empathy subscales. For competence, participants with low or average empathic concern and personal distress rated palsy faces as significantly more competent than scarred faces. However, this effect was nonsignificant at high levels of these traits (see Supplementary Materials for detailed results).

Do individual differences in empathy impact mechanistic dehumanization??

Empathic concern did not matter (Figure S7). However, perspective taking and personal distress (Table 3) did matter. The higher the tendency to take others' perspectives[5], the lower the dehumanization of anomalous faces (Figure S8). Greater personal distress[6] was associated with more

[1] This model better explained (AIC = 59799.3) the warmth perception than the model excluding personal distress (AIC = 59817.3).

[2] This model better explained competence perception (AIC = 35294.8) than the model excluding emphatic concern (AIC = 35446.6).

[3] This model better explained (AIC = 35415.8) the competence perception than the model excluding perspective taking (AIC = 35446.6).

[4] This model better explained (AIC = 35185.4) the competence perception than the model excluding personal distress (AIC = 35446.6).

[5] This model did better explain (AIC = 115053.3) the mechanistic dehumanization than the model excluding perspective taking (AIC = 115060.5).

[6] This model did better explain (AIC = 115013.2) the mechanistic dehumanization than the model excluding personal distress

dehumanization (Figure S9). Faces with palsies were dehumanized less than faces with scars. A similar pattern for interactions emerged for mechanistic dehumanization: participants with lower levels of empathic concern, perspective taking, or personal distress perceived palsy faces as more mechanistically dehumanized than scarred ones. Again, these differences diminished at high empathy levels (see Supplementary Materials).

Do individual differences in empathy impact animalistic dehumanization??

Empathic concern (Figure S10) and perspective taking (Figure S11) did not matter, but personal distress did (Table 4). The higher the personal distress[7], the higher the dehumanization (Figure S12). We observed no differences between anomalies. The interaction between personal distress and anomaly type was significant in the model, but none of the simple slopes reached statistical significance, suggesting a more nuanced or non-linear effect (see Supplementary Materials).

Do individual differences in sensitivity to disgust impact assessments of warmth??

Sensitivity to pathogen disgust (Figure S13) did not matter. Neither did moral disgust (Figure S14). Only sensitivity to sexual disgust impacted the assessment of warmth (Table 5). The higher the sensitivity to sexual disgust,[8] the lower the warmth assessments (Figure S15).

Do individual differences in sensitivity to disgust impact assessments of competence??

All forms of sensitivity to disgust had an effect (Table 6). The higher the sensitivity to disgust, the higher the competence assessments (Figure S16,[9], S17,[10] S18[11]). Faces with

Table 3 Results for empathy and mechanistic dehumanization

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Emphatic Concern	1.6520	0.6854	2.410 (1610.5256)	0.016	0.064
Anomaly Types	5.8192	1.0764	5.406 (1998.3302)	0.001	0.001
Emphatic Concern * Anomaly Types	– 1.3240	0.2661	– 4.976 (13429.5991)	0.001	0.001
Perspective Taking	– 0.4069	0.6806	– 0.598 (1608.1995)	0.550	–
Anomaly Types	3.7203	1.0884	3.418 (2082.8639)	0.001	0.003
Perspective Taking * Anomaly Types	– 0.7153	0.2639	– 2.711 (13424.6918)	0.007	0.027
Personal Distress	2.8774	0.5733	5.019 (1609.4930)	0.001	0.001
Anomaly Types	5.5395	0.9276	5.972 (1167.1543)	0.001	0.001
Personal Distress * Anomaly Types	– 1.2831	0.2237	– 5.736 (13432.0863)	0.001	0.001

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

Table 4 Results for empathy and animalistic dehumanization

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Emphatic Concern	0.4888	0.6756	0.724 (1621.5236)	0.469	–
Anomaly Types	2.1673	1.1003	1.970 (2145.5339)	0.049	0.196
Emphatic Concern * Anomaly Types	– 0.5095	0.2736	– 1.862 (13439.0459)	0.063	–
Perspective Taking	– 0.9152	0.6702	– 1.366 (1619.1088)	0.172	–
Anomaly Types	1.2496	1.1124	1.123 (2229.9192)	0.261	–
Perspective Taking * Anomaly Types	– 0.2450	0.2713	– 0.903 (13433.8333)	0.366	–
Personal Distress	1.6157	0.5664	2.852 (1619.8249)	0.004	0.018
Anomaly Types	1.8859	0.9467	1.992 (1246.1991)	0.047	0.186
Personal Distress * Anomaly Types	– 0.4432	0.2301	– 1.926 (13441.2975)	0.054	0.217

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

(AIC = 115060.5).

[7] This model did better explain (AIC = 115733.6) the animalistic dehumanization than the model excluding personal distress (AIC = 115738.1).

[8] This model did better explain (AIC = 59797.9) the warmth perception than the model excluding sensitivity to sexual disgust (AIC = 59817.3).

[9] This model better explained competence perception (AIC = 35385.4) than the model excluding sensitivity to pathogen disgust (AIC = 35446.6).

[10] This model explained (AIC = 35334.8) the competence perception better than the model excluding sensitivity to moral disgust (AIC = 35446.6).

[11] This model better explained (AIC = 35066.7) the competence perception than the model excluding sensitivity to sexual disgust (AIC = 35446.6).

Table 5 Results for sensitivity to disgust and warmth

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Pathogen Disgust	9.267e-03	8.929e-03	1.038 (1.579e+03)	0.299	–
Anomaly Types	– 8.894e-02	1.153e-01	– 0.771 (4.948e+02)	0.441	–
Pathogen Disgust * Anomaly Types	3.510e-04	3.000e-03	0.117 (1.340e+04)	0.907	–
Moral Disgust	8.232e-03	8.463e-03	0.973 (1.580e+03)	0.331	–
Anomaly Types	– 1.585e-01	1.113e-01	– 1.424 (4.305e+02)	0.155	–
Moral Disgust * Anomaly Types	2.922e-03	2.834e-03	1.031 (1.339e+04)	0.303	–
Sexual Disgust	– 3.558e-02	7.220e-03	– 4.928 (1.580e+03)	0.001	0.001
Anomaly Types	– 1.658e-01	1.015e-01	– 1.633 (2.993e+02)	0.103	–
Sexual Disgust * Anomaly Types	3.432e-03	2.447e-03	1.402 (1.340e+04)	0.161	–

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

Table 6 Results for sensitivity to disgust and competence

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Pathogen Disgust	2.784e-02	3.609e-03	7.715 (1.599e+03)	0.001	0.001
Anomaly Types	– 8.594e-02	4.681e-02	– 1.836 (7.988e+02)	0.067	–
Pathogen Disgust * Anomaly Types	8.242e-04	1.339e-03	0.616 (1.343e+04)	0.538	–
Moral Disgust	3.291e-02	3.373e-03	9.757 (1.603e+03)	<0.001	<0.001
Anomaly Types	– 1.575e-01	4.480e-02	– 3.515 (6.766e+02)	0.001	0.002
Moral Disgust * Anomaly Types	3.477e-03	1.265e-03	2.749 (1.342e+04)	0.006	0.024
Sexual Disgust	5.145e-02	2.662e-03	19.329 (1.623e+03)	<0.001	<0.001
Anomaly Types	– 1.597e-01	3.990e-02	– 4.001 (4.309e+02)	0.001	0.001
Sexual Disgust * Anomaly Types	3.806e-03	1.091e-03	3.488 (1.345e+04)	0.001	0.002

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

palsies were seen as more competent than faces with scars. Simple slopes analyses revealed that participants lower in moral or sexual disgust sensitivity perceived palsy faces as more competent than scarred ones. These differences decreased at higher levels of disgust sensitivity (see Supplementary Materials).

Do individual differences in sensitivity to disgust impact mechanistic dehumanization??

Sensitivity to pathogen (Figure S19) and moral (Figure S20) disgust did not matter. Only sensitivity to sexual disgust (Table 7) had an impact on mechanistic dehumanization. The higher the sensitivity to sexual disgust[12], the higher the dehumanization of anomalous faces (Figure S21). Faces with palsies were dehumanized less than faces with scars. The simple slopes analyses showed that individuals with lower sensitivity to moral or sexual disgust attributed more dehumanization to palsy than to scarred faces. Again, just as for competence, this pattern weakened at higher levels of disgust sensitivity (see Supplementary Materials).

Do individual differences in sensitivity to disgust impact animalistic dehumanization??

None of the types of sensitivity to disgust affected animalistic dehumanization (Table 8, Figures S22-S24). We observed no differences between anomalies.

[12] This model better explained (AIC = 115020.0) mechanistic dehumanization than the model excluding sensitivity to sexual disgust (AIC = 115060.5).

Table 7 Results for sensitivity to disgust and mechanistic dehumanization

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Pathogen Disgust	– 3.259e-02	4.997e-02	– 0.652 (1.608e+03)	0.514	–
Anomaly Types	2.071e+00	7.435e-01	2.785 (4.966e+02)	0.005	0.022
Pathogen Disgust * Anomaly Types	– 3.430e-02	1.935e-02	– 1.772 (1.342e+04)	0.076	–
Moral Disgust	– 3.326e-02	4.736e-02	– 0.702 (1.610e+03)	0.483	–
Anomaly Types	2.462e+00	7.175e-01	3.432 (4.316e+02)	0.001	0.003
Moral Disgust * Anomaly Types	– 4.927e-02	1.828e-02	– 2.695 (1.341e+04)	0.007	0.028
Sexual Disgust	2.168e-01	4.044e-02	5.361 (1.610e+03)	0.001	0.001
Anomaly Types	2.964e+00	6.543e-01	4.530 (2.997e+02)	0.001	001
Sexual Disgust * Anomaly Types	– 7.278e-02	1.577e-02	– 4.614 (1.343e+04)	0.001	0.001

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

Table 8 Results for sensitivity to disgust and animalistic dehumanization

	β	SE	t(df)	*p*	$p_{Bonferroni}$
Pathogen Disgust	– 1.033e-01	4.916e-02	– 2.101 (1.620e+03)	0.036	0.143
Anomaly Types	5.095e-01	7.549e-01	0.675 (5.222e+02)	0.500	–
Pathogen Disgust * Anomaly Types	– 5.368e-03	1.989e-02	– 0.270 (1.343e+04)	0.787	–
Moral Disgust	– 1.161e-01	4.656e-02	– 2.493 (1.621e+03)	0.013	0.051
Anomaly Types	8.381e-01	7.277e-01	1.152 (4.528e+02)	0.250	–
Moral Disgust * Anomaly Types	– 1.758e-02	1.879e-02	– 0.935 (1.342e+04)	0.350	–
Sexual Disgust	9.985e-02	4.003e-02	2.495 (1.619e+03)	0.013	0.051
Anomaly Types	9.937e-01	6.620e-01	1.501 (3.113e+02)	0.134	–
Sexual Disgust * Anomaly Types	– 2.504e-02	1.622e-02	– 1.544 (1.344e+04)	0.123	–

*Means interaction. We report Bonferroni corrections only for cases with significant *p*

Discussion

We aimed to study how individual differences in empathy and sensitivity to disgust affect the "reading" of anomalous faces with scars and palsies. Even though people for centuries suspected that "Imago animi vultus est" ("The face is the index of the mind") and people "read" inner traits from anomalous faces (Workman et al., 2022), little is known about the "reader" in this process. First, we discuss results relevant to our hypothesis. Then, we discuss the contributions of the exploratory variables.

We predicted that people who are less empathic and more sensitive to pathogen disgust would judge more harshly the warmth and competence of faces with visible differences and dehumanize them. People with less empathic concern did find anomalous faces to be less competent. This observation is consistent with the idea that empathetic people are unaffected by superficial facial features when assessing another person's capabilities. However, contrary to our prediction, empathic concern did not matter for assessments of warmth and forms of dehumanization. While the different ways people can be stereotyped correlate broadly, there are differences. In this case, judgments of competence are more sensitive to individual differences in empathic concern.

We did not confirm our hypothesis about sensitivity to pathogen disgust. Levels of pathogen sensitivity did not affect assessments of warmth and dehumanization. Rather, contrary to our prediction, we found that participants who were more sensitive to pathogen disgust were more likely to see anomalous faces as competent. Why would participants more sensitive to pathogen disgust rate anomalous faces as more competent than those less sensitive to pathogen disgust? A priori, we reasoned that seeing anomalous faces would increase feelings of disgust, and people sensitive to

disgust would judge anomalous faces more harshly. It seems that the relationship between anomalies and competence is more nuanced than we anticipated. It is worth mentioning that in some contexts, anomalies like scars are seen as evidence of greater competence. For instance, in 19th -century Germany, Mersur dueling scars were regarded as a badge of honor, and the most isolated members of the Hadza community assessed people with scars as more competent than people without any anomaly (Workman et al., 2022). However, how these cultural considerations explain our result related to pathogen disgust is unclear. Perhaps people with higher sensitivity to pathogen disgust "read" more competence in anomalous faces as compensation. Such compensation could occur because they wish to mitigate their biases and avoid unfairly treating someone they regard as an outgroup. Regardless of the explanation, we find that judgments of competence are not straightforward we might not be considering the full range of relevant variables.

We now turn to the variables we explored as contributing to the "reader's" biases– the impact of personal distress and perspective taking as other forms of empathy and sexual and moral types of sensitivity to disgust. Regarding empathy, the higher the personal distress, the lower the warmth and competence assessments, and the higher the mechanistic and animalistic dehumanization. Perspective-taking did not affect the "reading" of warmth, but the higher the perspective-taking, the higher the competence assessments and the lower the dehumanization of anomalous faces. These results make sense: participants who feel more stress when looking at anomalous faces judge them worse than those who feel less stress. Moreover, participants who more easily take the perspective of people with facial anomalies seem to judge them better.

Participants who were more sensitive to sexual disgust had lower warmth assessments. This result is consistent with past research, as those sensitive to disgust are also harsh judges (He et al., 2022). However, participants who were more sensitive to sexual disgust had higher competence assessments. As mentioned above, the relationship between disgust and competence in anomalous faces is puzzling. The higher the sensitivity to sexual disgust, the higher the dehumanization of anomalous faces. This result also makes sense: higher sensitivity is related to higher bias toward anomalous faces. Sensitivity to moral disgust was not related to warmth assessments and dehumanization, but higher sensitivity was related to higher competence assessments, just like sensitivity to sexual disgust.

Our study also presented similarities and differences regarding scars and palsies. Faces with palsies were seen as more competent than faces with scars and were dehumanized less, but only mechanistically. We observed no differences in warmth assessments and animalistic dehumanization. Future studies could look at other facial differences to understand more fully how different facial anomalies may play a role here. We could even go a step further and analyze types of the same anomaly, like scars on the upper or lower part of the face or with different etiology.

Our results showed the importance of the "reader's" psychological traits in the process of "face-reading". It confirms and adds to our understanding of the individual differences in the anomalous-is-bad stereotype. Having knowledge about individual differences in empathy and disgust sensitivity might improve decision-making and reduce bias toward people with anomalous faces. Because past studies showed that anomalous faces are seen as less competent, and such persons may be victims of stereotyping in workplaces and schools (Zebrowitz & Rhodes, 2004), we may try to prevent bias by paying more attention to the judge.

Our study is not free from limitations. First, we tested only two individual differences, so we still lack knowledge about other possible differences between "readers". Second, we tested participants only from one sample, so it is hard to make cross-cultural conclusions. The solution to this issue is to conduct more studies on diverse cultural samples. Third, we tested the perception of only faces with scars and palsies, so our results should not be generalized to all anomalies. Despite these limitations, we showed that the "reader" matters in anomalous "face-reading", and we claim that this finding should be implemented to prevent bias toward people with anomalous faces.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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