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ARTICLE

# First impressions: Do faces with scars and palsies influence warmth, competence and humanization?

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## Abstract

A glance is enough to assign psychological attributes to others. Attractiveness is associated with positive attributes ('beauty-is-good' stereotype). Here, we raise the question of a similar but negative bias. Are people with facial anomalies associated with negative personal characteristics? We hypothesized that biases against faces with anomalies arise because of negative stereotypes (less warmth and competence) and forms of dehumanization (animalistic and mechanistic). We enrolled 1493 mTurk participants ($N = 1306$ after exclusion) to assess 31 traits of photographed people using 60 pairs of photographs of the same person before and after plastic surgery. Half anomalous faces had a scar and the other half had a palsy. To calculate warmth and competence, we conducted a principal components analysis of the 31 attributes. Animalistic dehumanization was assessed by averaging reverse-scored ratings corresponding to moral sensibility and rationality/logic, and mechanistic dehumanization by averaging across reverse-scored ratings corresponding to emotional responsiveness and interpersonal warmth. We found that both kinds of anomalous faces were seen as less warm, competent and were dehumanized. Our findings suggest that an 'anomalous-is-bad' stereotype generalizes regardless of the aetiology of the anomaly. This effect may be related to a reverse halo effect, that is, the horn effect.

**KEYWORDS**
competence, dehumanization, face perception, palsy, scar, warmth

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## BACKGROUND

First impressions from faces have real-world consequences (Olivola et al., 2014). They may bear on financial success (Duarte et al., 2012; Rule & Ambady, 2011) and judicial decisions (Jaeger et al., 2020; Wilson & Rule, 2015). A well-established 'beauty-is-good' phenomenon occurs, wherein positive characteristics are attributed based on physical beauty. Attractive people, compared to less attractive people, are seen as possessing more socially desirable personality traits and leading better lives (Dion et al., 1972), being 'purer' (Klebl et al., 2021), more trustworthy (Villavisanis et al., 2022) and having a 'more beautiful' heart (Cui et al., 2019). More positive impressions of attractive people are related to a halo effect (Eagly et al., 1991), a tendency to assess others positively in many areas based on at least one positive judgement about them.

As a complement to the 'beauty-is-good' stereotype, an 'anomalous-is-bad' stereotype posits that people with visible facial differences are seen not only as less attractive but also as less moral (Jamrozik et al., 2019; Workman et al., 2022). This stereotype may be related to a reverse-halo effect, that is, the horn effect, a cognitive bias where a negative overall impression of a person influences the perception of their specific traits or abilities (Thorndike, 1920; Zeigler-Hill et al., 2021). So, someone who is less attractive may also be less moral. In this study, we use the stereotype content model (SCM) and related frameworks on mind perception and dehumanization to investigate mechanisms underlying the 'facial-anomaly-is-bad' hypothesis. The SCM classifies biases along two fundamental axes: warmth and competence (Fiske, 2012, 2018). According to the SCM, when encountering strangers, we make reflexive judgements about their warmth (do they have good or bad intentions?) and competence (how capable are they of acting on those intentions?). Viewers admire people high in warmth and competence, envy people *low* in warmth and *high* in competence, pity people *high* in warmth but *low* in competence and denigrate people who are low in *both* warmth and competence (e.g., drug addicts and homeless people). This model generalizes to people's attitudes towards group stereotypes (Cuddy et al., 2007; Fiske, 2018) (e.g., ethnicity and avocations) and can predict when and how people discriminate against members of novel groups (Jenkins et al., 2018). While the SCM posits that targets of discrimination are perceived to have *bad intentions* (low warmth), dehumanization and mind perception frameworks postulate different and subtle ways that people in outgroups are regarded as less than human, including having less capacity for intention in the first place. They might be assumed to have less capacity for complex emotions, such as pride and embarrassment (Leyens et al., 2003) or as having less uniquely human attributes (more animalistic) or less human nature attributes (more mechanistic, like automata) (Haslam et al., 2005) or to have reduced capacity for agency to sense and experience the world (Gray et al., 2007, 2011). Prejudicial attitudes and potential discriminatory behaviour towards people with facial anomalies could be driven by one or more of these subtle or explicit psychological factors.

Millions of people have visible differences, like scars and palsies. In contrast to the ubiquity of scars, which Hollywood has used for decades as visual shorthand signifying moral corruption (Croley et al., 2017), permanent palsies are less common (Fuller & Morgan, 2016). Visible differences may engender different manifestations of the anomalous-is-bad stereotype. For example, American participants judged individuals with facial differences as having less desirable personality traits (e.g., emotional stability), internal (e.g., intelligence) and social attributes (e.g., trustworthiness) (Jamrozik et al., 2019). Despite observing these results, we still have much to learn about the nature of the anomalous-is-bad stereotype, especially regarding the perception of other traits and attributes. Previous studies, including those from our group, have not distinguished between different kinds of facial anomalies. Here, we examine how scars and palsies can produce different reactions to those faces. Scars are usually rendered by an external cause, such as injuries from accidents and altercations (but there are some exceptions, e.g., acne or infections). Facial asymmetries are usually caused by an internal source, such as a stroke or Bell's palsy. We reasoned that an internal biological source of a facial anomaly might be more susceptible to being associated with negative internal psychological traits than an anomaly from an external source. Moreover, symmetrical faces are usually considered more attractive because they reflect better

phenotypic quality (Perrett et al., 1999) and palsies are a prime example of an asymmetrical face, even if many faces with scars often display less severe asymmetries.

We also examined two ways of arriving at negative psychological characterization. One is along social dimensions of warmth and competence (Fiske et al., 2007). The second is framed according to different forms of dehumanization-animalistic and mechanical (Kuljian & Hohman, 2022).

## FACE-READING OF WARMTH, COMPETENCE AND DEHUMANIZATION

Social perceptions may be organized along the dimensions of warmth and competence (Abele & Wojciszke, 2013). Warmth is also sometimes called communion (Abele & Wojciszke, 2007) or morality (Phalet & Poppe, 1997). Competence (Fiske, 1998, 2018; Fiske et al., 2002, 2007) is sometimes called agency (Abele & Wojciszke, 2013) or ability (Brycz & Wojciszke, 1992). Warmth signals a person's relation to others, for example, if someone is friendly or empathetic (Abele & Brack, 2013; Brambilla et al., 2011, 2021). Competence signals one's ability to accomplish goals and is related to skills like intelligence and efficiency (Abele & Brack, 2013; Brambilla et al., 2011, 2021).

Individuals regard more attractive people as warmer and more competent (Dion et al., 1972; Eagly et al., 1991). Visible differences lower perceptions of warmth (Jamrozik et al., 2019; Workman et al., 2021, 2022; Zebrowitz et al., 2003). However, evidence for a negative effect of visible differences on competence is mixed. Anomalous faces can elicit impressions of lower competence than attractive faces (Zebrowitz et al., 2003). Understanding how warmth and competence are read from faces is important for understanding how social impressions are formed and can offer insight into discriminatory attitudes people harbour towards individuals with facial differences.

Dehumanization is another way of characterizing negative stereotypes (Kuljian & Hohman, 2022). Dehumanization refers to perceiving a person or group as lacking 'humanness' (Harris & Fiske, 2011; Haslam et al., 2012; Smith, 2014) or denying their capacity for rich inner lives (e.g., emotional and/or cognitive) that characterizes what it means to be human (Rai et al., 2017). Two types of dehumanization can occur: animalistic and mechanistic (Haslam, 2006; Haslam & Murphy, 2020). The first entails likening people to animals (i.e., animalistic dehumanization) and denies them human capacities such as morality, maturity, refinement, civility, rationality and logic. The second entails likening people to inanimate objects (i.e., mechanistic dehumanization) and denies them capacities for emotional experiences, interpersonal warmth, cognitive openness, agency, individuality and depth. Some indirect evidence suggests that faces with visible differences are subjected to animalistic dehumanization (Workman et al., 2021). However, whether such faces also trigger mechanistic dehumanization has not been studied. We suspect that people with facial anomalies may also be dehumanized in this way because individuals tend to mechanistically dehumanize specific groups with less power or who suffer more, such as the mentally ill (Boysen et al., 2020; Martinez et al., 2011) or medical patients (Lammers & Stapel, 2011; Vaes & Muratore, 2013) and people with facial anomalies may be treated similarly.

## THE CURRENT RESEARCH

Based on the previous findings about the perception of people with facial anomalies (e.g., Hartung et al., 2019; Jamrozik et al., 2019; Workman et al., 2021), we predicted that faces with facial anomalies would be seen as less warm, competent and would be more dehumanized than those same faces after surgical intervention. To test our hypothesis, we asked participants to assess 31 inner traits of photographed people and their attractiveness and age. We used 60 pairs of photographs of the same people before and after plastic surgery. Half anomalous faces had a scar and another half had a palsy (see details in the procedure section).

The present study builds on previous work in several key ways:

1. We studied two kinds of anomalies (i.e., scars and palsies) to measure whether they elicit differences in face perception. In previous studies, participants rated faces with heterogeneous visible differences (e.g., Jamrozik et al., 2019; Workman et al., 2021), making it impossible to specify findings to any one kind of anomaly. We hypothesize that the consequences of visible differences for first impressions may depend on the specific anomaly a given face harbours. Internally generated anomalies and facial asymmetries, in this case, might be more subject to negative stereotypes than externally derived scars. We made this prediction because of two reasons. First, symmetrical faces are usually considered more attractive because they reflect better phenotypic quality (Perrett et al., 1999). Second, palsies may be seen as having arisen from an internal source compared to scars as having an external source (of course, this does not have to be true for every type of palsy, but we suspected that most people would use this heuristic to think about facial anomalies). Following the research on belief in a just world (Lucas et al., 2011; Workman et al., 2021), some may believe that people get what they deserve, so if someone has a facial anomaly with an inner source, it may mean that they deserved it via some negative inner traits.
2. We probed for two types of dehumanization (i.e., animalistic and mechanistic). Previous work, based on patterns of neural activity, provided indirect evidence that anomalous faces trigger animalistic dehumanization (Workman et al., 2021). However, it remains to be seen whether visible differences also trigger mechanistic dehumanization. On this account, people with facial anomalies are seen as things rather than people, a potentially important source of negative biases (Lammers & Stapel, 2011; Vaes & Muratore, 2013).
3. We also examined the relationship between both forms of stereotyping. Since animalistic dehumanization implies less refinement and intelligence, we might expect that animalistic dehumanization would correlate inversely with competence. Analogously, because mechanical dehumanization denies a rich emotional life, we might expect that mechanical dehumanization would correlate inversely with warmth.
4. We used tightly controlled stimuli (i.e., photographs of real people before and after plastic surgery; every pair was a photo of the same person) (Workman & Chatterjee, 2021), contrary to past research that used synthetic faces generated by a computer. Using photographs of real people instead of generated faces has advantages such as having stimuli close to real-life (ecological validity) or real faces may elicit more natural and complex patterns of neural activity compared to computer-generated faces, providing researchers with a better understanding of the underlying neural mechanisms involved in face perception and social cognition (see also: Cook & Over, 2021). Additionally, we used a diverse set of faces regarding race, age and gender to avoid possible bias based on demographic features. For example, women can be seen as warmer but less competent and less human than men (reviewed by Haslam & Loughnan, 2014). This way, we avoid the limitations of past studies that typically used mainly White faces (Chatterjee & Workman, 2021; Cook & Over, 2021; Workman & Chatterjee, 2021).
5. We also examined whether perceived attractiveness and age have a protective effect on negative stereotyping. Attractiveness is a powerful signal used to form first impressions about others (e.g., Cui et al., 2019; He et al., 2022). Age also seems to be a powerful signal such that youth is seen in a more positive light than ageing (Erber & Long, 2006; He et al., 2021; Miller et al., 2009; North & Fiske, 2012, 2015). For instance, older people in many countries (Durante et al., 2017) are viewed as less competent but warmer than younger people (Fiske et al., 2007; Wojciszke, 2005). Older people are also perceived as more moral and morality is a component of warmth (Sorokowski et al., 2023).

## Hypotheses

**Hypothesis 1.** Anomalous faces are subject to an 'anomalous-is-bad' stereotype. Anomalous faces will be rated more negatively in terms of warmth and competence and will be more dehumanized (in animalistic and mechanistic ways) compared to the same

faces after corrective surgery (H1a). Furthermore, we predict that faces with asymmetries will elicit more negative stereotypes than faces with scars (H1b).

**Hypothesis 2.** The negative appraisals of faces with visible differences based on warmth and competence will be related to forms of dehumanization. Specifically, we predict that competence and animalistic dehumanization will be inversely correlated (H2a), and warmth and mechanistic dehumanization will be inversely correlated (H2b).

**Hypothesis 3.** We hypothesize that higher perceived facial attractiveness will decrease the level of dehumanization (both types) (H3a) and increase the level of perceived warmth and competence (H3b).

**Hypothesis 4.** We hypothesize that higher perceived age will increase the level of dehumanization (both types) (H4a) and increase the level of perceived warmth but decrease their level of perceived competence (H4b).

This preregistered study (https://doi.org/10.17605/OSF.IO/M56WB) was reviewed and approved by the Institutional Review Board at the University of Pennsylvania. The materials, data and analysis codes are available at: https://osf.io/kf654/?view_only=None. The preregistration lacks direct hypotheses, which are present in this manuscript.

## Participants

We aimed to recruit 1500 participants. Using effect sizes calculated from the data reported by Jamrozik et al. (2019), a minimum of 102 responses per dimension was expected to provide sufficient power (80%) to detect differences in warmth and competence judgements when comparing anomalous faces before and after surgical correction. Acquiring 102 responses per dimension also ensured sufficient reliability (Cronbach's $\alpha > .8$). We targeted over 120 responses per face rating dimension to provide a buffer against exclusions of low-quality data.

Healthy adult volunteers aged 18 and older from the United States were recruited through Amazon's Mechanical Turk service to complete an online survey (Buhrmester et al., 2018). Participants could not have significant visual impairments that would disrupt their ability to complete the study. The survey took approximately 30 min and participants were compensated $4 for their time. We used attention checks to detect whether participants were engaged throughout the survey (see materials at OSF: https://osf.io/kf654/?view_only=None). Following our preregistered criteria, we excluded participants who failed more than 2 of 3 attention checks. Additionally, we asked participants whether they believed their data was high-quality enough to be included in the study (Curran, 2016). Their data were not used if they answered negatively on this question.

A total of $N = 1493$ individuals took part in our study. After implementing our preregistered exclusion criteria, the sample size was $N = 1306$ ($n = 446$ women; $n = 854$ men; $n = 1$ other; $n = 1$ non-binary; $n = 4$ did not wish to say) with a mean age of $M = 36.51$ ($SD = 10.23$ years; range: 20–84) and a mean education of $M = 14.82$ ($SD = 2.97$ years; range: 1–26). Regarding race and ethnicity, $n = 1086$ participants were white, $n = 100$ African-American, $n = 51$ Asian, $n = 27$ American-Indian, $n = 1$ was Pacific-Islander, $n = 25$ were multiracial, $n = 6$ chose the option 'other', $n = 10$ did not wish to say. We also asked if participants identified as Hispanic or Latino; $n = 275$ answered positively, $n = 1019$ negatively and $n = 12$ did not wish to say. Regarding sexual orientation, $n = 957$ participants identified as heterosexual, $n = 38$ homosexual, $n = 285$ bisexual, $n = 9$ pansexual, $n = 3$ asexual, $n = 2$ chose the option 'other', and $n = 12$ did not wish to say. Regarding political attitudes on social issues, the mean was $M = 4.42$ ($SD = 1.99$; range: 1 – *very liberal* to 7 – *very conservative*). Regarding political attitudes on economic issues, the mean was $M = 4.61$ ($SD = 1.91$; range: 1 – *very liberal* to 7 – *very conservative*).

## Procedure

The study had a within-subject design. After giving consent and receiving instructions on completing the online survey via the Qualtrics platform, participants began a face rating task (Jenkins et al., 2018). In sum, they completed 33 ratings (31 regarding different traits, 1 regarding the perceived attractiveness of presented faces and 1 regarding the perceived age of presented people) on 10 randomly selected face rating tasks (330 ratings total) rather than rating all 120 faces chosen for the study (60 pre-treatment and 60 post-treatment; 30 with palsies and 30 with scars). This procedure aimed to reduce the testing burden placed on participants, given the many ratings participants provided for each face as part of each trial. After the face rating task, participants filled out additional surveys and questions (see the section below).

## Measures

### *Face rating task*

Photographs of faces with palsies and scars were selected from the ChatLab Facial Anomaly Database (Workman & Chatterjee, 2021) (see Figure 1 for exemplary stimuli). This database was created controlling for smiling and presenting various stimuli regarding race and sex.

The faces were diverse in age, race, ethnicity and sex. The structure of the face rating task was adapted from earlier studies (Jamrozik et al., 2019; Workman et al., 2021). Participants completed a total of 10 trials. In each trial, participants were shown a face with a facial anomaly that either had or had not undergone surgical correction to reduce the visual salience of any anomalies. Each face remained on screen while participants rated the face along the 31 dimensions (sincere, tolerant, natured, trustworthy, friendly, helpful, moral, understanding, intelligent, efficient, skilled, confident, creative, capable, foresighted, clever, capable of hunger, capable of fear, capable of pain, capable of rage, capable of desire, capable of pleasure, capable of pride, capable of embarrassment, capable of joy, communicative, knowledgeable about others' feelings, capable of remembering things, capable of telling right from wrong, capable of planning, capable of self-control).

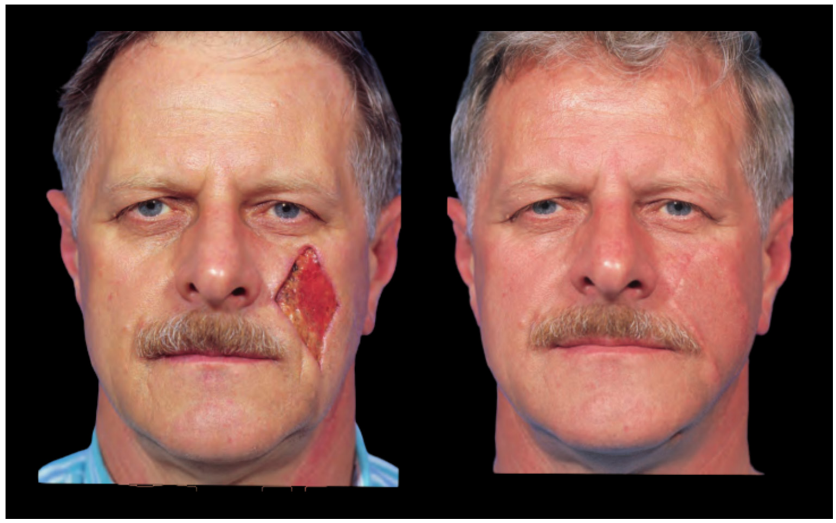

**FIGURE 1** Exemplary stimuli of a face with a scar. *Note*. Participants saw these faces separately, so they could not directly compare faces before and after correction.

*Warmth & competence*

Participants were asked to assess the extent to which people presented in the photographs possessed warmth traits (i.e., sincere, tolerant, good-natured, trustworthy, friendly, helpful, moral and understanding of others) and competence traits (i.e., intelligent, efficient, skilled, confident, creative, capable, foresighted and clever) (Jenkins et al., 2018). Ratings were made using a 100-point scale ranging from 1 – *not at all [trait]* to 100 – extremely *[trait]*. Following the approach used by Jenkins et al. (2018), principal component analysis with varimax rotation was performed on the ratings of the 31 attributes using the 'psych' package in R. For use in computational modelling, we calculated overall warmth and competence scores for each recipient.

*Attractiveness & Age*

Faces were also rated for attractiveness on a scale from 1 – *not at all attractive* to 100 – *extremely attractive*. Participants also reported the perceived age of each face they saw.

*Dehumanization*

We measured two types of dehumanization: animalistic and mechanistic.

*Animalistic dehumanization*

Animalistic dehumanization was assessed by averaging across reverse-scored ratings corresponding to moral sensibility (morality, telling right from wrong, trustworthiness and good-naturedness) and rationality/logic (planning, self-control, intelligence and cleverness) (Haslam, 2006). Participants were asked to assess to what extent people presented in the photographs possessed the mentioned trait.

*Mechanistic dehumanization*

Mechanistic dehumanization was assessed by averaging across reverse-scored ratings corresponding to emotional responsiveness (knowing others' feelings, embarrassment, pride and joy) and interpersonal warmth (sincerity, friendliness, helpfulness and tolerance) (Haslam, 2006). Participants were asked to assess the extent to which people presented in the photographs possess the mentioned trait.

*Psychological dispositions*

Participants' psychological dispositions were assessed using several scales: the Interpersonal Reactivity Index assessed facets of trait empathy (Davis, 1983), the Three Domains of Disgust scale assessed sensitivity to different kinds of disgust (Tybur et al., 2009), the Social Dominance Orientation scale assessed egalitarianism (Pratto et al., 1994) and the Procedural and Distributive Just World Beliefs scale assessed beliefs about justice (Lucas et al., 2007, 2011). Analyses of these individual differences in psychological dispositions are beyond the scope of the current manuscript and will be described elsewhere. Participants also reported their demographic characteristics, including age, gender, sexual orientation, education and political views on social and economic issues.

## Preregistered analysis plan

We conducted a principal components analysis of the 31 attributes linked to warmth and competence, isolating up to 10 factors with varimax rotation using the 'psych' package in R. Linear mixed-effects models were used to test whether the dependent variables (animalistic dehumanization, mechanistic dehumanization, warmth and competence) were significantly affected by face type (pre-treatment, post-treatment). Random intercepts for the subject and item were modelled. We obtained $p$ values for the parameter estimates generated by each model using Satterthwaite's approximation as implemented by the lmerTest package (Kuznetsova et al., 2017). We reported regression coefficients ($\beta$), standard errors (SE) and $t$-values generated with the effects package (Fox & Weisberg, 2018). Null models were computed

for comparison and the Akaike information criterion (AIC), which estimates out-of-sample prediction error, was compared. The model with the superior AIC was selected.

## RESULTS

First, we conducted the principal components analysis, which resulted in two components based on 31 traits related to warmth and competence (see attached code at OSF). Second, we tested how participants perceived faces before and after surgery. Table 1 presents the descriptive statistics.

### Testing hypothesis 1a

We predicted that anomalous faces would be rated more negatively regarding warmth and competence and more dehumanized (in animalistic and mechanistic ways) compared to the same faces after corrective surgery. We confirmed this hypothesis. Anomalous faces were rated as less warm and competent and were dehumanized (animalistic and mechanistic) compared to the same faces after corrective surgery.

#### Detailed results

To examine the effect of the facial anomaly on warmth, a linear mixed model was constructed with warmth as the dependent variable and treatment (pre-treatment|post-treatment) and type of anomaly (palsy vs. scar) as fixed factors. Random intercepts for face stimulus and subject were modelled. There was a significant main effect of treatment ($\beta = 0.50369$, $SE = 0.06612$, $t(119.20876) = 7.618$, $p < .001$, AIC = 59,773.0) but not of type of anomaly ($\beta = -0.08774$, $SE = 0.06609$, $t(119.10689) = -1.328$, $p = .187$). There was no significant two-way interaction between treatment and type of anomaly ($\beta = -0.165603$, $SE = 0.131328$, $t(119.086310) = -1.261$, $p = .210$). Anomalous faces were seen as less warm than the same faces after surgery.

To examine the effect of the facial anomaly on competence, a linear mixed model was constructed with competence as the dependent variable and treatment (pre-treatment|post-treatment) and the type of anomaly (palsy vs. scar) as fixed factors. Random intercepts for face stimulus and subject were modelled. There was a significant main effect of treatment ($\beta = 0.17713$, $SE = 0.03645$, $t(119.07701) = 4.860$, $p < .001$, AIC = 35,420.2) but not of type of anomaly ($\beta = -0.02791$, $SE = 0.03608$, $t(118.43279) = -0.774$, $p = .441$). There was no significant two-way interaction between treatment and type of anomaly ($\beta = -0.07677$, $SE = 0.05151$, $t(118.97198) = -1.490$, $p = .139$). Anomalous faces before treatment were seen as less competent than surgically corrected faces.

To examine the effect of the facial anomaly on animalistic dehumanization, a linear mixed model was constructed with animalistic dehumanization as the dependent variable and treatment

**TABLE 1** Descriptive statistics for warmth, competence, animalistic and mechanistic dehumanization, perceived attractiveness and perceived age.

| | Warmth | Competence | Animalistic dehumanization | Mechanistic dehumanization | Attractiveness | Age |
|---|---|---|---|---|---|---|
| Anomalous *M* | 10.066 | −0.969 | 45.083 | 44.479 | 46.831 | 59.870 |
| *SD* | 2.999 | 1.437 | 17.543 | 17.520 | 23.035 | 17.291 |
| Corrected *M* | 10.622 | −0.834 | 41.676 | 41.260 | 51.777 | 51.240 |
| *SD* | 2.884 | 1.370 | 16.581 | 16.836 | 21.707 | 17.149 |
| Scale | 0.179–17.937 | −8.052–4.777 | 0–100 | 0–100 | 0–100 | 0–100 |

(pre-treatment|post-treatment) and the type of anomaly (palsy vs. scar) as fixed factors. Random intercepts for face stimulus and subject were modelled. There was a significant main effect of treatment ($\beta = -3.1323$, $SE = 0.4344$, $t(119.1701) = -7.211$, $p < .001$, AIC = 115,698.4) but not of type of anomaly ($\beta = 0.4140$, $SE = 0.4342$, $t(119.0676) = 0.953$, $p = .342$). There was no significant two-way interaction between treatment and type of anomaly ($\beta = 0.93442$, $SE = 0.86434$, $t(119.03751) = 1.081$, $p = .282$). Anomalous faces before treatment were dehumanized more than surgically corrected faces.

To examine the effect of the facial anomaly on mechanistic dehumanization, a linear mixed model was constructed with mechanistic dehumanization as the dependent variable and treatment (pre-treatment|post-treatment) and a type of anomaly (palsy vs. scar) as fixed factors. Random intercepts for face stimulus and subject were modelled. There was a significant main effect of treatment ($\beta = -3.5877$, $SE = 0.6245$, $t(119.3068) = -5.745$, $p < .001$, AIC = 115,023.0) but not of type of anomaly ($\beta = 0.5185$, $SE = 0.6185$, $t(118.8455) = 0.838$, $p = .404$). There was no significant two-way interaction between treatment and type of anomaly ($\beta = 1.3403$, $SE = 0.8828$, $t(119.2303) = 1.518$, $p = .132$). Anomalous faces before treatment were dehumanized more than surgically corrected faces.

## Testing hypothesis 1b

We predicted that faces with asymmetries will elicit more negative stereotypes than faces with scars. However, we did not find differences between faces with scars and palsies for these measured variables (see Table 2 for descriptive statistics and Figures S1–S4).

## Testing hypotheses 2a and 2b

We predicted that competence and animalistic dehumanization will be inversely correlated (2a), and warmth and mechanistic dehumanization will be inversely correlated (2b). We did not confirm hypothesis 2a, but we confirmed hypothesis 2b.

### Detailed results

We analysed only data from anomalous faces. We found a negative correlation between warmth and mechanistic dehumanization ($r_{\text{Spearman's}} = -.965$, $p = .001$), confirming hypothesis 2b. Surprisingly, we found a small positive correlation between competence and animalistic dehumanization ($r_{\text{Spearman's}} = .127$, $p = .001$), not confirming hypothesis 2a. We also exploratory tested the differences

**TABLE 2** Descriptive statistics regarding the type of anomaly (Palsy vs. Scar).

| | Group | *N* | *M* | *SD* | *SE* |
|---|---|---|---|---|---|
| Warmth | Palsy | 6516 | 10.373 | 2.973 | 0.037 |
| | Scar | 6544 | 10.299 | 2.940 | 0.036 |
| Competence | Palsy | 6516 | −0.869 | 1.371 | 0.017 |
| | Scar | 6544 | −0.938 | 1.440 | 0.018 |
| Animalistic dehumanization | Palsy | 6516 | 43.265 | 17.259 | 0.214 |
| | Scar | 6544 | 43.588 | 17.074 | 0.211 |
| Mechanistic dehumanization | Palsy | 6516 | 42.341 | 17.514 | 0.217 |
| | Scar | 6544 | 43.485 | 16.998 | 0.210 |
| Attractiveness | Palsy | 6516 | 49.395 | 22.695 | 0.281 |
| | Scar | 6544 | 49.069 | 22.376 | 0.277 |

between scars and palsies. For scars, the correlation between competence and animalistic dehumanization was $r_{Spearman's} = .111$, $p = .001$ and between warmth and mechanistic dehumanization was $r_{Spearman's} = -.972$, $p = .001$. For palsies, the correlation between competence and animalistic dehumanization was $r_{Spearman's} = .142$, $p = .001$, and between warmth and mechanistic dehumanization was $r_{Spearman's} = -.971$, $p = .001$. All correlations between measured variables are in the Supplementary Materials (Tables S1–S3).

## Testing hypothesis 3a and 3b

We hypothesized that higher perceived facial attractiveness would decrease the level of dehumanization (both types) (3a) and increase the level of perceived warmth and competence (3b). We confirmed hypothesis 3a, as perceived attractiveness interacted with treatment to predict warmth, animalistic and mechanistic dehumanization. More attractive faces were seen as warmer than less attractive faces, regardless of surgical intervention. Similarly, more attractive faces were dehumanized less (animalistically and mechanistically) than less attractive faces, no matter if the faces were corrected or not. Attractiveness interacted with the type of anomaly, with less attractive faces with scars seen as less competent and less mechanistically dehumanized than faces with palsies.

### Detailed results

To examine the effect of the facial anomaly on attractiveness, a linear mixed model was constructed with attractiveness as the dependent variable and treatment (pre-treatment|post-treatment) and a type of anomaly (palsy vs. scar) as fixed factors. Random intercepts for face stimulus and subject were modelled. There was a significant main effect of treatment ($\beta = 4.7144$, $SE = 0.7026$, $t(119.5058) = 6.710$, $p < .001$, AIC = 127,094.0), but not of type of anomaly ($\beta = -0.1420$, $SE = 0.7023$, $t(119.4201) = -0.202$, $p = .840$) and no interaction between treatment and type of anomaly ($\beta = 0.1725$, $SE = 1.4048$, $t(119.4355) = 0.123$, $p = .902$). Anomalous faces before treatment were seen as less attractive than surgically corrected faces after treatment (Figure S5).

Next, we conducted a linear mixed model with warmth as the dependent variable and treatment (pre-treatment|post-treatment) and the type of anomaly (palsy vs. scar) and attractiveness as fixed factors. Random intercepts for face stimulus and subject were modelled. There was a significant main effect of treatment ($\beta = 5.716e\text{-}01$, $SE = 9.055e\text{-}02$, $t(5.600e{+}02) = 6.312$, $p < .001$), attractiveness ($\beta = 5.510e\text{-}02$, $SE = 1.064e\text{-}03$, $t(1.396e{+}04) = 51.805$, $p < .001$), but not of type of anomaly ($\beta = 5.457e\text{-}02$, $SE = 8.566e\text{-}02$, $t(4.711e{+}02) = 0.637$, $p = .524$). There was a significant two-way interaction between treatment and type of anomaly ($\beta = -3.570e\text{-}01$, $SE = 1.279e\text{-}01$, $t(5.593e{+}02) = -2.791$, $p = <.01$) and between treatment and attractiveness ($\beta = -4.734e\text{-}03$, $SE = 1.369e\text{-}03$, $t(1.350e{+}04) = -3.459$, $p = <.001$) (AIC = 55,179.8). Simply put, more attractive faces were seen as warmer, similarly for palsies and scars. Additionally, less attractive faces with palsies after their surgical correction were seen as warmer compared to less attractive faces with palsies before the correction. We found no other interactions (Figure S6).

We repeated the same analyses for competence. There was a significant main effect of treatment ($\beta = 1.712e\text{-}01$, $SE = 4.602e\text{-}02$, $t(5.541e{+}02) = 3.719$, $p < .001$), attractiveness ($\beta = 5.305e\text{-}03$, $SE = 5.389e\text{-}04$, $t(1.403e{+}04) = 17.268$, $p < .001$) and type of anomaly ($\beta = -1.219e\text{-}01$, $SE = 4.354e\text{-}02$, $t(4.664e{+}02) = -2.799$, $p < .01$). There was a significant two-way interaction between type of anomaly and attractiveness ($\beta = 2.083e\text{-}03$, $SE = 6.684e\text{-}04$, $t(1.349e{+}04) = 3.116$, $p < .01$) (AIC = 34,713.2). Simply put, more attractive faces were seen as more competent, similarly for palsies and scars. Additionally, the surgical correction of palsies increased competence perception of corrected faces, no matter if they were seen as less or more attractive. Reading faces with scars only if they were seen as less attractive, the correction of scars increased the perceived competence of such faces. We found no other interactions (Figure S7).

Next, we followed the same analyses for animalistic dehumanization. There was a significant main effect of treatment ($\beta = -3.477e+00$, $SE = 6.284e-01$, $t(5.167e+02) = -5.532$, $p < .001$), attractiveness ($\beta = -3.424e-01$, $SE = 7.201e-03$, $t(1.425e+04) = -47.542$, $p < .001$), but not for type of anomaly ($\beta = -2.035e-01$, $SE = 5.955e-01$, $t(4.368e+02) = -0.342$, $p = .733$). There was a significant two-way interaction between treatment and type of anomaly ($\beta = 1.844e+00$, $SE = 8.878e-01$, $t(5.161e+02) = 2.077$, $p < .05$) and between treatment and attractiveness ($\beta = 2.879e-02$, $SE = 9.329e-03$, $t(1.354e+04) = 3.086$, $p < .01$) (AIC = 111,692.9). Simply put, more attractive anomalous faces were dehumanized less. Additionally, we observed lower dehumanization of less attractive faces with palsies after their surgical correction compared to less attractive faces with palsies before the correction. We found no other interactions (Figure S8).

We followed the same analyses for mechanistic dehumanization. There was a significant main effect of treatment ($\beta = -3.247e+00$, $SE = 6.454e-01$, $t(4.466e+02) = -5.031$, $p < .001$), attractiveness ($\beta = -2.996e-01$, $SE = 7.133e-03$, $t(1.415e+04) = -42.001$, $p < .001$) and for the type of anomaly ($\beta = 1.304e+00$, $SE = 6.136e-01$, $t(3.813e+02) = 2.125$, $p < .05$). There was a significant two-way interaction between treatment and type of anomaly ($\beta = 2.038e+00$, $SE = 9.118e-01$, $t(4.458e+02) = 2.235$, $p < .05$), between treatment and attractiveness ($\beta = 2.063e-02$, $SE = 9.219e-03$, $t(1.353e+04) = 2.238$, $p < .05$) and between the type of anomaly and attractiveness ($\beta = -1.850e-02$, $SE = 8.870e-03$, $t(1.349e+04) = -2.086$, $p < .05$) (AIC = 111,581.6). Simply put, more attractive faces were dehumanized less. Additionally, we observed lower dehumanization of less attractive faces with palsies after their surgical correction compared to less attractive faces with palsies before the correction. We found no other interactions (Figure S9).

We confirmed hypothesis 4b, as older faces were seen as warmer (Figure S10) but less competent (Figure S11) than younger faces, but we did not confirm hypothesis 4a as we observed the reverse effect: older faces were dehumanized less than younger faces, which was true for animalistic and mechanistic dehumanization (Figures S12 and S13). See Data S1 for detailed results.

## DISCUSSION

We aimed to understand how faces with scars and palsies before and after surgery are seen regarding their warmth and competence and whether they are dehumanized animalistically or mechanistically. We confirmed and replicated our basic findings that faces before correction were associated with negative personal characterizations. They were seen as less warm and competent, confirming the 'anomalous-is-bad' stereotype (Workman et al., 2021). They were also subject to more mechanistic and animalistic dehumanization. We also found that all faces with anomalies were assessed as less attractive than the same faces after surgical correction. Moreover, the attractiveness of anomalous faces had a protective effect on negative psychological assessments. Specifically, more attractive faces were considered warmer, more competent and less likely to be dehumanized. Finally, we found that older faces were less dehumanized than younger faces. They were also seen as warmer but less competent than younger faces.

Contrary to past studies that use a wide range of stimuli (e.g., Workman et al., 2021), we focused on two types of anomalies, making it possible to test for differences between them. Our predictions about differences between impressions of scars and facial asymmetries were not confirmed. We reasoned that asymmetry might play a role and that an internal biological cause for a facial difference would be more closely associated with a negative judgement of an internal psychological state than a facial anomaly rendered externally. We did not find evidence for this difference. Similar to the reverse halo effect (i.e., the horn effect) in which negative attributes generalize across different objects, negative assessments might also generalize in an undifferentiated manner. Additionally, one could imagine that scars signal lower warmth and higher competence (as sometimes depicted in movie villains or historically in duelling scars) and that palsies might signal lower competence if thought to signal compromised health. However, we did not observe such differences. Any facial anomaly made participants see them as less warm, less competent and more dehumanized animalistically and mechanistically. Another possibility worth considering is that some scarred faces in our stimuli were asymmetrical. Further studies should

include more accurate measurements of the face. One could also argue that in men, non-severe facial scarring might make a person more attractive (Burriss et al., 2009). However, we used faces with severe scars (see Figure 1) in this study.

We also looked more deeply at the role of facial attractiveness and age. We confirmed our hypothesis that attractiveness helps, regardless of anomaly. Attractive faces were seen as warmer, more competent and dehumanized less. We also confirmed our hypothesis about age, showing that older faces were seen as warmer but less competent. However, contrary to our prediction, we showed that older faces were dehumanized less than younger faces and this was true for all tested conditions. This result is contrary to stereotypes about age and it requires future studies to replicate it and help explain the mechanism behind it.

The first impressions based on the perception of anomalous faces have many social consequences, from avoiding sitting next to someone who has facial anomaly (Houston & Bull, 1994) or not being willing to date them (Mojon-Azzi et al., 2008; Robert et al., 1998), to serious violence (Madera & Hebl, 2012; Strauss et al., 2007; Tartaglia et al., 2005). Identifying mechanisms that enable the 'anomalous-is-bad' bias would help devise interventions to reduce or eliminate the bias.

We consider at least three possible generalization mechanisms for the negative bias. First, the bias may be related to 'familiar-face overgeneralization' (the adaptive value of differentiating friends from foes or known individuals from strangers produces a strong tendency to respond to face familiarity, which generalizes to misattributed impressions of strangers who vary in their resemblance to known individuals) (Zebrowitz, 2017). Second, 'emotional-face overgeneralization' (the adaptive value of responding appropriately to emotional expressions, such as avoiding an angry person or approaching a happy person, produces a tendency to respond to facial qualities that reveal emotions and this tendency is overgeneralized to misattributions of people whose facial structures resemble particular emotional expressions) (Zebrowitz, 2017). Third, 'unfit-face overgeneralization' (the adaptive value of recognizing evolutionarily unfit people with genetic anomalies or disease), which allows one to reject them as mates or to avoid contagion, produces a strong tendency to respond to facial qualities that mark low fitness. This is overgeneralized to misattributions of unattractive people whose facial features resemble those of individuals who are low in fitness (Zebrowitz, 2017). This last mechanism is challenged since culture in some settings might account for negative judgements of faces with scars (Workman et al., 2022).

Finally, we also examined the relationship between the two routes to negative stereotyping. Specifically, if lower warmth is associated with more mechanistic dehumanization and if lower competence is associated with more animalistic dehumanization. We found that lower warmth was strongly related to higher mechanistic dehumanization. However, we did not confirm the other hypothesis, as lower competence was related to lower animalistic dehumanization. This result may be because people tend not to like competence in others who might be competitors (Landy et al., 2016). Importantly, across the comparisons, judgements of warmth more than competence had an effect of negative stereotyping of facial anomalies.

Our study has some limits. First, we used photographs of the same faces before and after the surgery. In some cases, the image has a residual sign, for example, still a small palsy or evidence of the past scar, which might still be evident and trigger a negative stereotype. On the other hand, this fact may be an advantage as even in such realistic cases, surgery improves face perception. Also, while we used the same people's faces, those with anomalies were, by definition, younger before their corrective surgery. We took care to minimize emotional expressions in the ChatLab Facial Anomaly Database (Workman & Chatterjee, 2021). However, presurgical faces could have had subtle signs of anxiety and post-surgical faces might have had subtle signs of relief or happiness. Second, we studied only one sample from one WEIRD culture (i.e., White, Educated, Industrialized, Rich and Democratic) (Henrich et al., 2010), as some research suggests different patterns of moral judgements in non-WEIRD samples (Smith & Apicella, 2022; Sorokowski et al., 2020). In our facial anomalies study with the Hadza tribe, the patterns of stereotyping found did not replicate what we found in WEIRD samples (Workman et al., 2022). Future research should include more diverse samples in the face-reading of anomalous faces. Third, we used real photographs to overcome problems with computer-generated photographs (Cook & Over, 2021) but

risk losing some precise control over the fine features of the faces themselves. Fourth, our sample was collected on mTurk, and participants were paid, possibly impacting response bias (Goodman et al., 2013). Future studies could replicate our findings in, for instance, community samples.

Because millions of people worldwide experience prejudice as a result of having a facial anomaly, our study has practical implications and might inform intervention strategies to prevent bias towards people with visible differences. Our study confirms and adds to our understanding of the 'anomalous-is-bad' stereotype. Not only are attractive faces seen more positively, but faces with anomalies elicit more negative evaluations compared to the same faces before the surgery. If people with facial anomalies are seen as less competent, they may be victims of stereotyping in workplaces, schools and other environments. They might also be seen as less warm. Based on a long line of research (Brambilla et al., 2011, 2021; Brambilla & Leach, 2014; Goodwin et al., 2014; Landy et al., 2016; Stasiuk et al., 2023), we know that others' morality, including their warmth, is a critical trait in forming impressions. Being seen as less warm (and less moral) may damage individuals' quality of social interactions as people need to think that they are good and are seen as good by others (Prentice et al., 2019; Strohminger, 2018). Moreover, being dehumanized is harmful, as it strongly impacts self-assessments. Dehumanized people see themselves in a bad light, as less intelligent or not worthy of living, and feel shame, guilt, sadness or anger (Bastian & Haslam, 2011). Such destructive emotions and negative thoughts about oneself as an effect of dehumanization lower the quality of life and also impact mental health by increasing anxiety and depression (Fontesse et al., 2021).

Can these biases be countered? Interventions in which people are repeatedly exposed to faces with anomalies that are paired with prosocial vignettes could be used to mitigate negative biases. We are conducting such interventions. Activist groups like Facial Equality International (https://faceequalityinternational.org/) are raising popular awareness of the 'facial-anomaly-is-bad' stereotype. Changing Faces mounted an 'I am not your Villain' campaign (https://www.changingfaces.org.uk/get-involved/campaign-with-us/i-am-not-your-villian/) to push back against popular movies, amplifying the negative bias in the public imagination. Much more needs to be done.

## CONCLUSION

We found that people with facial anomalies are associated with negative characteristics. Specifically, anomalous faces with scars and palsies were seen as less warm, competent and dehumanized (in animalistic and mechanistic ways). Our study indicates that the 'anomalous-is-bad' stereotype generalizes regardless of whether the cause of the anomaly is internally caused or externally rendered.

### AUTHOR CONTRIBUTIONS

**Mariola Paruzel-Czachura:** Conceptualization (equal); investigation (equal); writing – original draft (lead); writing – review and editing (lead); methodology (equal); validation (equal); visualization (lead); project administration (equal); formal analysis (lead). **Clifford I. Workman:** Conceptualization (equal); investigation (equal); data curation (equal); writing – original draft (supporting); writing – review and editing (supporting); methodology (equal); validation (equal); project administration (equal). **Noha El Toukhy:** Data curation (equal); investigation (equal); writing – review and editing (supporting); methodology (equal). **Anjan Chatterjee:** Conceptualization (equal); funding acquisition (lead); writing – original draft (lead); writing – review and editing (lead); supervision (lead); resources (lead); investigation (equal).

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### CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

## DATA AVAILABILITY STATEMENT

Preregistration: https://doi.org/10.17605/OSF.IO/M56WB. The materials, data and analysis codes: https://osf.io/kf654/?view_only=None.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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