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Article

Keywords: beauty, disfigurement, face perception, moral character, culture, Hadza

Posted Date: December 21st, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-1169909/v1>

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Evidence against the “anomalous-is-bad” stereotype in Hadza hunter gatherers

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Word count: 2,003

Abstract

People have an “anomalous-is-bad” stereotype whereby they make negative inferences about the moral character of people with craniofacial anomalies like scars. This stereotype is hypothesized to be a byproduct of adaptations for avoiding pathogens. However, evidence for the anomalous-is-bad stereotype comes from studies of European and North American populations; the byproduct hypothesis would predict universality of the stereotype. We presented 123 Hadza across ten camps pairs of morphed Hadza faces—each with one face altered to include a scar—and asked who they expected to be more moral and a better forager. Hadza with minimal exposure to other cultures chose at chance for both questions. Hadza with greater exposure to other cultures, however, expected the scarred face to be less moral and a better forager. These results suggest the anomalous-is-bad stereotype is culturally shared, providing evidence against a universal pathogen avoidance byproduct hypothesis.

Keywords: beauty; disfigurement; face perception; moral character; culture; Hadza

If Hollywood is to be believed, then people are usually only as *good* as they are good looking. In contrast to heroes, movie villains are more frequently depicted with visible facial anomalies, like scars, that negatively impact perceptions of attractiveness.¹ In the *Star Wars* universe, for instance, Anakin Skywalker's transformation into Darth Vader is marked by the simultaneous corruption of his moral character and of his physical form. The notion that facial appearance weighs on character is more than just a familiar storytelling device—participants from primarily English-speaking countries have a “beauty-is-good” stereotype and are more likely to ascribe positive personal qualities to beautiful people.^{2–5} On the other hand, US students and online workers have an “anomalous-is-bad” stereotype and are more likely to ascribe negative qualities to people with deviations from prototypically attractive features (e.g., craniofacial anomalies), especially negative attributions of moral character.^{5–8}

People may use craniofacial anomalies and other deviations from facial typicality to infer moral character because these anomalies are perceived as cues to infectious disease. Humans have an evolved behavioral immune system to identify and avoid potential vectors of pathogens, using cues that were historically associated with increased pathogen risk, such as coughs, sneezes, lesions, and bodily fluids.⁹ The behavioral immune system will sometimes make mistakes, and because of the high cost of missing a potential pathogen threat,^{10,11} people will erroneously infer pathogen threat from irrelevant cues. These cues may include facial anomalies, even when such anomalies are acquired independently of any underlying illnesses.¹² Indeed, facial anomalies and unattractive faces are treated as expressions of infectious disease that elicit disgust and avoidance in perceivers.^{13–15} Moreover, expressions of negative bias in attitudes and behavior towards people with facial anomalies are predicted by disgust-sensitive brain responses to anomalous faces,^{6–8} further evidence that disgust underpins reactions to

anomalous faces and that people erroneously infer pathogen threat from anomalies.¹² Disgust is a shared affective response that motivates avoidance to pathogen and moral threats,^{16,17} and people may infer negative moral character from experiences of disgust to avoid immoral others.^{18,19}

If the anomalous-is-bad stereotype is a byproduct of adaptations designed to detect and avoid potential pathogen threats, then it should be expressed broadly across cultures, which requires testing in diverse samples.²⁰ However, most of the evidence for the stereotype comes from Western populations, which are outliers on many psychological dimensions compared to the global population.^{21,22} Existing evidence on perceptions of trustworthiness from facial appearance suggests variation of the stereotype between and within cultures. For example, Dutch²³, US, and Japanese²⁴ adults vary in the extent to which they believe traits can be inferred from facial features (i.e., lay physiognomy beliefs), and people with stronger beliefs in physiognomy are more likely to form character impressions using facial appearance. Further, the extent to which people infer trustworthiness and dominance from facial appearance varies across cultures.²⁵ While these studies did not examine the anomalous-is-bad stereotype cross-culturally, they provide evidence that specific impressions formed from facial appearance are not universal.

Here, we examine the anomalous-is-bad stereotype among the Hadza hunter-gatherers of Tanzania. The Hadza are not isolated, and have had contact since at least the 19th century with neighboring populations, including Datoga, Isanzu, Sukuma, and Maasai;²⁶ however, they have had minimal contact with Western media, such as television, magazines, and cinema. We asked participants to choose between pairs of faces—one with and one without a superimposed scar (see Figure 1)—and asked them to indicate which face appeared more moral and which appeared to be a better forager. If the Hadza are no less likely to choose the scarred face, then this would be evidence that the anomalous-is-bad stereotype is not universal. We ask about morality and

foraging ability because some evidence suggest that the stereotype is specific to morality,⁵ and foraging ability is an important dimension on which Hadza evaluate campmates.^{27,28} Asking about foraging ability thereby allows us to examine the specificity of the stereotype. Finally, we also explore variation within the Hadza as a function of exposure to non-Hadza cultures. Exposure to non-Hadza cultures is associated with economic biases,²⁹ emotional closeness to other ethnic groups,³⁰ greater sharing in an economic game,³¹ and preferring to live with more generous campmates.²⁷ Exposure may similarly moderate how they infer character qualities about other Hadza.

Figure 1. A sample set of composite male faces used in the experiment (face set M1, condition A). The complete set of stimuli are available at <https://osf.io/eqftk/>.

Results

Table 1 presents the proportion of responses choosing the anomalous face by face set, condition, and trait. Before presenting estimates from the model, two patterns are noticeable in the raw data. First, collapsed across all face sets, participants were more likely to choose the anomalous face for good forager, and this pattern was observed within all but one face set. Second, collapsed across all face sets, participants were less likely to choose to the anomalous face for good heart, and this pattern was observed in five of the eight face sets and conditions.

Table 1. Proportion of Responses Choosing Anomalous Face by Face Set, Condition, and Trait

Face set	Condition	Good forager	Good heart
F1	A	0.39	0.34
	B	0.59	0.54
F2	A	0.52	0.28
	B	0.50	0.59
M1	A	0.63	0.45
	B	0.54	0.43
M2	A	0.60	0.39
	B	0.54	0.52
Total		0.54	0.43

Note. Numeric values are the proportion of responses that chose the anomalous face for that trait.

Face sets with women are notated with “F”, and face set with men are notated with “M.” The only difference between conditions was which face had the photoshopped scar.

Table 2 presents the estimates from the marginal posterior distribution for each population parameter. When considering who is a better forager, the probability of preferring the anomalous face was positive; further, the effect of exposure on the probability of choosing the anomalous face as a better forager was positive. When considering who has a better heart, the probability of preferring the anomalous face was negative; further, the effect of exposure on the probability of choosing the anomalous face as having a better heart was negative.

Table 2. Parameter Estimates from the Marginal Posterior Distributions of the Model

Parameter	Median	90% HDI	<i>pd</i>	% in ROPE
Good forager	0.25	-0.03, 0.54	0.932	33.1
Good heart	-0.27	-0.59, 0.05	0.921	29.6
Good forager × Exposure	0.13	-0.03, 0.30	0.910	68.3
Good heart × Exposure	-0.13	-0.29, 0.04	0.913	69.7

Note. The point estimate is the median value of the marginal posterior distribution. The 90% highest density interval (HDI) is the smallest interval that contains 90% of the posterior distribution, *pd* is the proportion of the posterior in the same direction as the median, and % in ROPE is the proportion of the posterior distribution falling between the region of practical equivalence (-0.18 – 0.18).

We next examined the joint posterior prediction distribution and whether, across the population, participants preferred the non-anomalous face for each trait, collapsing across

participant exposure, face, and condition. The probability of preferring the anomalous face as a better forager was greater than chance, *Median* = 0.57, 90% highest density interval (HDI): 0.48 – 0.68, probability of direction (*pd*) = 0.899. The probability of preferring the anomalous face as having a better heart was less than chance, *Med.* = 0.42, 90% HDI: 0.31 – 0.52, *pd* = 0.900.

Finally, we examined the joint posterior prediction distribution by participants' exposure to other cultures. Examining participants with the lowest exposure, the probability of preferring the anomalous face as a better forager was about, *Med.* = 0.52, 90% HDI: 0.43 – 0.61, *pd* = 0.630, 57.3% in the region of practical equivalence (ROPE), and similarly the probability of preferring the anomalous face as having a better heart was about chance, *Med.* = 0.48, 90% HDI: 0.38 – 0.57, *pd* = 0.660, 53.0% in ROPE. However, for participants with the highest exposure, the probability of preferring the anomalous face as a better forager was greater than chance, *Med.* = 0.63, 90% HDI: 0.53 – 0.74, *pd* = 0.972, 8.9% in ROPE, whereas the probability of preferring the anomalous face as having a better heart was less than chance, *Med.* = 0.36, 90% HDI: 0.26 – 0.47, *pd* = 0.972, 8.8% in ROPE. Figure 2 presents the estimated probabilities as a function of exposure to non-Hadza culture for each trait.

Figure 2. Joint posterior predictions by participants' exposure to non-Hadza culture as a z-score and trait being evaluated. Lines are the median estimate from the posterior and shaded regions are the 90% highest density intervals (HDI). Points are individual responses (for plotting, exposure values were rounded to the nearest tenth). Dashed lines indicate the region of practical equivalence (ROPE).

Discussion

People in English-speaking populations have a beauty-is-good stereotype, inferring that people perceived as more attractive are more moral and that people perceived as physically unattractive are less moral.^{3,5} People with deviations from facial typicality, such as craniofacial anomalies like scars, are especially likely to be viewed as morally worse, whether they are perceived as attractive or not. In other words, people have an anomalous-is-bad stereotype.⁶ We found evidence that this stereotype is not culturally universal. Hadza hunter-gatherers with minimal exposure to other cultures were not more likely to think other Hadza with facial scarring were less moral or worse foragers. However, Hadza who regularly interact with outside cultural groups were more likely to think Hadza with facial scarring were less moral and were better foragers. These results suggest the anomalous-is-bad stereotype is culturally shaped, providing evidence against the hypothesis that the stereotype is a universal byproduct of the behavioral immune system.

Cultural exposure may moderate character inferences among the Hadza through the acquisition of beliefs from neighboring populations about what constitutes facial attractiveness. Previous research finds that culture influences attractiveness judgments. For example, South African Zulu migrants to the UK rated women with lower body-mass index and waist-to-hip ratio as more attractive compared to Zulus residing in South Africa.³² South Korean students with greater exposure to US media are more likely to rate thin models as attractive.³³ Hadza find more average Hadza faces more attractive, but not more average white European faces, suggesting exposure to different faces is necessary to judge average faces as more attractive.³⁴ Some Hadza may have learned from neighboring populations that facial scars are unattractive and consequently infer negative character traits from facial scarring. Alternatively, Hadza could

believe facial scarring is unattractive but, through exposure to non-Hadza culture, acquire beliefs linking specific traits with attractiveness. US, Japanese, and Dutch participants who do not believe traits can be inferred from facial features are less likely to make such inferences,^{23,24} providing direct evidence that explicit beliefs can influence the social evaluation of faces. Some Hadza may similarly learn associations between moral character and attractiveness from neighboring populations. We do not have the data to explore either hypothesis in the current study, however, and addressing these alternatives is a goal of future research.

Exposure to non-Hadza cultures could also moderate the extent to which Hadza engage in mentalizing. That is, norms and beliefs about whether one can or should know another's mind vary cross-culturally, with Westerners viewing the mind as both knowable and attributable to one's actions.^{35,36} Accordingly, in Western populations, intent to do harm or to commit moral violations is central to moral character judgments.^{37,38} The intention to do wrong suggests a desire to act, which informs inferences about the potential for committing future moral violations. That is, intention suggests moral character is conceptualized as stable among Western participants.³⁹ There is variation across populations in the extent to which intention influences moral judgments, however, and many small-scale populations—such as the Hadza, Himba, and Yesawa—do not condemn intentional actions more than unintentional actions.^{40,41} Hadza also disagree on perceptions of who is more moral²⁸ and do not infer moral character from others' judgments in response to sacrificial moral dilemmas,⁴² suggesting they may not conceive of morality as a stable characteristic. If this is right, then moral character should not be associated with other relatively stable traits, such as facial appearance. With increasing exposure to other cultures, however, Hadza may update their concept of moral character such that they are more willing to infer character from stable physical characteristics.

Surprisingly, participants with greater exposure to non-Hadza culture thought Hadza with scars were better foragers. Prior studies report that people make negative attributions from physical unattractiveness for a broad range of traits, including competence,^{3,8} whereas others report effects specific to moral traits.⁵ This finding could be an experimental artifact because foraging judgments were always asked after good heart judgments. Participants could have avoided selecting the same faces for both traits, such that picking the unscarred face for the good heart judgment would likely be followed by picking the scarred face for foraging. However, in previous studies, Hadza do not have difficulty discriminating between pairs of faces presented multiple times.^{34,43} Another explanation is that accidents and injuries happen somewhat frequently during foraging bouts.⁴⁴ Hadza with facial scars may look more “bush-like” to other Hadza with exposure to non-Hadza populations, who then interpret scars as indicators of foraging ability.

Do we assume people with facial anomalies are villains because they are portrayed as such in movies, or are villains portrayed with facial anomalies because of a pre-existing association between morality and beauty? Our data suggest that culture shapes the inferences people draw from physical appearance. Specifically, we find that the anomalous-is-bad stereotype is not expressed universally and is largely absent among Hadza without exposure to other cultures. However, there is variation within the Hadza as a function of their exposure. This study provides evidence against the hypothesis that the anomalous-is-bad stereotype is a byproduct of adaptations to avoid pathogens. The contrast between these findings and earlier work that detected the anomalous-is-bad stereotype in Western populations highlights the importance of including more diverse populations in person perception research.

Method

Population

The Hadza are a population of nomadic hunter-gatherers living in northwestern Tanzania. About 1,000 people today speak Hadzane and identify as Hadza, but only approximately 300 still obtain a majority of their calories from foraged goods.^{44,45} Hadza live in temporary residence bands called camps, with about 20-30 adults and children in each camp. Camps usually consist of about two to three unrelated nuclear families.⁴⁵ Camps move location every six to eight weeks as local resources are consumed, and any individual can move freely to another camp at any time. Each year, individual Hadza interact with about one-fifth of the foraging population,⁴⁶ and from year to year, Hadza live with approximately one-in-five of their previous campmates.⁴⁷ The Hadza are highly interdependent with their campmates, and all food brought back to camp—especially meat—is shared with all other members of the camp.⁴⁴ Like other hunter-gatherer populations, the Hadza have a sexual division of labor, in which men hunt for large game and collect honey, while women collect plant goods such as tubers and berries.⁴⁴ The ethnographic record does not mention ritualistic scarring among the Hadza. They are known, however, to have historically made small vertical or lateral incisions on the cheeks with a small knife for aesthetics, to mark children as “Hadza,” and to apply medicine when treating injuries and ailments.^{26,44,48} The small scars are still observed in a minority of the population.

Sample

KMS and a team of research assistants visited 10 camps in September and October 2019. Camps were sampled using a snowball sampling procedure—after finishing interviews at one camp, someone in the camp would direct the research team to the next nearest camp. There was no predetermined sample size. The team sampled camps until no more camps could be located,

and interviewed 126 adults, with three exclusions for cognitive impairments that prevented participants from understanding the task. The final sample was 123 adults (60 women, 89 married) with a mean age of $M = 37.6$ ($SD = 14.2$) years. Each participant made eight decisions in the experimental task for a total of 984 observations in our analysis.

Procedure

Forced-choice task. Participants were presented with four pairs of same-sex faces that were composite photographs representing novel Hadza. In each pair, one face had visible scars while the other had no scarring. After looking at each pair, participants chose the person they believed better exemplified a given trait. Participants were first asked which person in the photograph had a better heart, which is a judgment of global moral character⁴⁹. Participants indicated their choice by pointing at the photograph. After answering for all four pairs, participants were again presented each pair and asked which man was a better hunter and which woman was a better gatherer. Participants always saw the pairs in the same order, with the two male pairs presented first. The questions were also asked in the same order each time. Before their interviews, participants were randomly assigned to a condition by coin flip. The only difference between conditions was which face in each pair had visible scarring. This part of the interview was conducted in Hadzane by a Hadza research assistant and overseen by a Tanzanian research assistant.

Survey of exposure to other cultures. We estimated the extent to which each participant had been exposed to non-Hadza cultures using their knowledge of and experience with the surrounding cultural groups. Specifically, participants reported the number of years they attended school, whether they had worked a job, how high they could count in Swahili, if they had visited Arusha or lived outside of Hadzaland, if they knew the capital of Tanzania, and whether they

knew the Tanzanian president, Barack Obama, Nelson Mandela, and Mahatma Gandhi. A two-factor structure best fit the data with responses to all but the questions about international figures loading better on to the first factor. A standardized composite score was computed using the weighted sums from the first factor as a measure of exposure to other cultures.²⁷ This part of the interview was conducted in Swahili by a Tanzanian research assistant and overseen KMS.

Stimuli

The experimental stimuli were constructed using 2D headshot photographs acquired from actual Hadza as part of an earlier study.⁴⁹ Consenting adult Hadza were photographed in 2016 with a Fujifilm Instax Mini 90 Classic Instant Film Camera. To standardize the photographs, participants were—whenever possible—positioned in front of a portable screen and instructed to adopt an emotionally neutral facial expression.

A total of 32 face photographs (16 male, 16 female) were pre-processed using established procedures^{6,50}: First, the photographs were normalized to inter-pupillary distance with algorithms from the OpenCV computer vision library (<https://opencv.org/>) and facial landmarks from the dlib machine learning toolkit (<http://dlib.net/>). Second, they were resized and cropped in IrfanView (<https://irfanview.com/>; width: 380px; height: 570px) and then edited automatically (remove.bg, <https://www.remove.bg/>) and then manually (GIMP 2, <https://www.gimp.org/>) to remove backgrounds.

After pre-processing, each of the 32 face photographs was submitted to the InterFace software package, used to place landmarks at 82 fiducial points on each face.⁵¹ The resulting coordinates were converted to JPsychoMorph format.⁵² Then, JPsychoMorph's averaging feature was used to generate 16 composite images (8 male, 8 female) derived from subsets of 4 male or female faces from the complete set of 32 photographs. This required a total of 64 photographs

(16 composites x 4 faces), so all 32 photographs were used twice (always in different composites). Next, visual inspection was used to identify and eliminate 8 composites that looked unrealistic owing to averaging errors. This resulted in a set of 8 useable composites (4 male, 4 female).

Finally, copies of the 8 composites were manually edited in Adobe Photoshop. Specifically, images of real bodily scars identified through web searches were carefully superimposed onto copies of all 8 composites. The final set of stimuli was 16 composites of four male and female faces, with an anomalous and non-anomalous version of each.

Data analysis and computation

We analyzed participants' decisions in a Bayesian multilevel regression model.⁵³ We modeled the choice as a Bernoulli function with probability p of choosing the anomalous face; $\text{logit}(p)$ was a function of the trait the participant was being asked about, the participant's exposure to other cultures and its interaction with the trait in question. We specified the model not to estimate an intercept and instead estimated each effect as a difference from responding at chance, with separate estimates for each trait. We included varying slopes of each trait for participant and camp. In addition, for face set, we included varying slopes for each condition, each trait, and their interactions. This approach effectively estimates which face for each set was more likely to be picked for each trait. All varying effects were modeled as multivariate normal distributions. Priors were weakly regularizing priors centered around zero. Prior predictive checks verified that all but the most extreme of values (e.g., choosing the anomalous or non-anomalous face with $> 95\%$ probability) were plausible under our priors.

In the analyses, we present marginal posterior distributions of the population parameters and posterior distributions of predicted probabilities. For the distribution of predicted

probabilities, we compute expected probability of choosing the anomalous face from trait, exposure, face set, and condition. We then collapse estimates across variables not of interest for the analysis to get a marginal posterior of the predicted values. We use the median of the distribution as a measure of the central tendency, 90% HDI as a measure of uncertainty, *pd* as a measure of existence of an effect, and percent of the posterior in the ROPE as a measure of significance.⁵⁴ HDI is the smallest continuous interval of values that 90% of the posterior falls between, *pd* is the proportion of the posterior above (or below depending on the sign of the median) zero (for parameters values) or 0.50 (for predicted probabilities), and % in ROPE is the proportion of the posterior distribution that falls within a predefined region around zero (or 0.50). Existence is the probability there is an effect in the direction indicated by the median, whereas significance (as indicated by the inverse of the percent in ROPE) is the probability that the effect is practically different from zero.⁵⁵ We defined the ROPE as the interval of -0.18 – 0.18 following guidelines for a “small” effect for standardized coefficients in logistic regression.^{54,56}

We conducted the analyses in R (4.1.1), using the brms package (2.15.0)⁵⁷ with cmdstanr (0.4.0)⁵⁸ to fit the model, the tidyverse (1.3.1)⁵⁹ package for data wrangling and visualization, and the tidybayes (3.0.0)⁶⁰ and modelr (0.1.8)⁶¹ packages for summarizing posterior distributions and predictions. We fit the model with two chains using within-chain parallelization, with 10,000 iterations each, 5,000 of which were for warmup, for a total of 10,000 samples post-warmup. Visual inspection showed that the chains were well-mixed, and for every parameter the effective number of samples in the bulk and tail of the distributions was >2,000, indicating effective sampling of the posterior.

Transparency and ethics

The study design and data analysis plan were not preregistered. Materials, de-identified data, R scripts, and statistical output are publicly available at <https://osf.io/eqftk/>. Study protocols were approved by the IRB at the University of Pennsylvania and permission to conduct research in Tanzania was approved by the Tanzanian Commission for Science and Technology. Permission to work in a camp was granted by each camp as a group and verbal consent to participate in research from each participant was obtained individually.

Acknowledgments: Research reported in this publication was supported by the National Institute of Dental & Craniofacial Research of the National Institutes of Health (F32DE029407 awarded to CIW), the Edwin and Fannie Gray Hall Center for Human Appearance at the University of Pennsylvania, and the University of Pennsylvania MindCORE program. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders. We would like to thank Endeko Endeko, Victoria Maghali, and Ibrahim Mabulla for help in collecting data, and Audax Mabulla for providing administrative support in Tanzania.

Conflict of interest statement: The authors declare no competing financial interests.

Author contributions: CIW contributed to securing funding, conceiving and designing the study, creating the stimuli, and writing the manuscript, KMS contributed to securing funding, conceiving and designing the study, data collection, data analysis, and writing the manuscript, CLA contributed to conceiving and designing the study and writing the manuscript, AC contributed to securing funding, conceiving and designing the study, and writing the manuscript.

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