Social Class Perception Is Driven by Stereotype-Related Facial Features

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In press at *Journal of Experimental Psychology: General.*

Abstract

Social class is a powerful hierarchy that determines many privileges and disadvantages. People form impressions of others' social class (like other important social attributes) from facial appearance, and these impressions correlate with stereotype judgments. However, what drives these related subjective judgments remains unknown. That is, what makes someone *look* like they are of higher or lower social class standing (e.g., rich or poor) and how does this relate to harmful or advantageous stereotypes? We addressed this question using a perception-based data-driven method to model the specific 3D facial features that drive social class judgments and compared them to those of stereotype-related judgments (competence, warmth, dominance, trustworthiness), based on White Western culture participants and face stimuli. Using a complementary data-reduction analysis and machine learning approach, we show that social class judgments are driven by a unique constellation of facial features that reflect multiple embedded stereotypes: poor-looking (vs. rich-looking) faces are wider, shorter, and flatter with downturned mouths and darker, cooler complexions, mirroring features of incompetent, cold, and untrustworthy-looking (vs. competent, warm, and trustworthy-looking) faces. Our results reveal the specific facial features that underlie the connection between impressions of social class and stereotype-related social traits, with implications for central social perception theories, including understanding the causal links between stereotype knowledge and social class judgments. We anticipate that our results will inform future interventions designed to interrupt biased perception and social inequalities.

Keywords: social class, facial features, person perception, reverse correlation, stereotypes

Public Significance Statement

People who are perceived to be of high or low social class standing (e.g., rich or poor) are also often judged as having advantageous or harmful traits, such as (in)competence and (un)trustworthiness. Such judgments are formed even just from facial appearance, which can have substantial downstream consequences. Here, we reveal the facial features that underlie these related subjective judgments among young, White, Western individuals. Our results provide new insights into what makes someone *look* rich or poor, and how these judgments relate to positive and negative stereotypes. Together with previous research, these results suggest that certain people could look rich or poor based on inferences related to stereotypes (e.g., that rich people are competent). We anticipate that our results could be used for interventions designed to address bias.

Social Class Perception Is Driven by Stereotype-Related Facial Features

Social hierarchies exist across species and cultures (e.g., Chiao, 2010; Ellis, 1993) and have important consequences for individual lives and wider societal functioning (e.g., Koski et al., 2015). In human societies, social class is a central hierarchy (e.g., Kraus et al., 2013) defined by a variety of factors, including education level, occupation, income, and wealth (Côte, 2011), that affects health (e.g., Adler et al., 2000; see also e.g., Sapolsky, 2004, 2005) and access to opportunities (e.g., Morrison, 2019; Richardson et al., 2020; Whitty, 2001). Even those simply perceived to be of a higher social class (e.g., richer) are often believed to be more competent (Bjornsdottir, 2019; Durante et al., 2017; Kraus et al., 2019; Oh et al., 2020), intelligent, and successful (Christopher & Schlenker, 2000), with more positive dispositions (Bjornsdottir, 2019; Bjornsdottir & Rule, 2017, 2020; Diener & Biswas-Diener, 2002; though stereotypes of warmth vary, see Durante et al., 2017; Fiske et al., 2002; Lindqvist et al., 2017; Tanjitpiyanond et al., 2022), and are given more employment and economic opportunities (Bjornsdottir & Rule, 2017; Kraus et al., 2019; Nelissen & Meijers, 2011; Rivera, 2012; Rivera & Tilcsik, 2016) than those perceived to be of lower social class (e.g., poorer).

As with many other consequential social judgments, such as trustworthiness and competence (e.g., Todorov et al., 2005; Sutherland et al., 2018), people readily form impressions (i.e., subjective judgments) of others' social class from their facial appearance (Bjornsdottir & Rule, 2017; see also Kraus et al., 2019; Kraus & Keltner, 2009, for other nonverbal cues).[1] These social class judgments also consistently correlate with judgments of social traits such as competence, in line with stereotypes (Bjornsdottir, 2019; Bjornsdottir &

[1] Throughout, our use of the terms "subjective judgments" and "subjective perceptions" refers to the impressions that perceivers form of others based on their facial appearance, which frequently show high consensus (e.g., Bar et al., 2006). Here, these impressions furthermore do not make reference to any objective measure of the social attributes in the stimuli.

Rule, 2017; see Kraus et al., 2019, for similar findings for accent). These consistent relationships suggest that the subjective perception of social class—where group membership may not necessarily be perceptually obvious—could be largely explained by social stereotyping and driven by certain stereotype-related facial features. Indeed, recent research supports this possibility, showing (both correlationally and causally) that stereotypes predict associations between perceptions of traits and social group memberships from faces (Bin Meshar et al., 2021; see also Stolier et al., 2018b, 2020). However, it remains unknown what specific facial features drive impressions of social class and how they relate to those of stereotype-related judgments, thus limiting investigation of this explanation.

We examined this critical missing link by modelling the facial features that drive subjective judgments of social class and comparing them to those driving judgments of social traits that are stereotypically associated with social class. We used a data-driven approach that combines classic reverse-correlation methods from ethology (e.g., Tinbergen, 1948), vision science (e.g., Ahumada & Lovell, 1971; Mangini et al., 2004; Murray, 2011), neuroscience (e.g., Hubel & Wiesel, 1959; Nishimoto et al., 2006; Zhan et al., 2019b), and engineering (e.g., Thompson et al., 1999; Volterra & Whittaker, 1959; Wiener, 1958; see Jack & Schyns, 2017, for a review) with a modern computer graphics-based 3D generative model of the human face and subjective human social perception (Zhan et al., 2019a, 2021). Specifically, we agnostically generated different face identities and measured the statistical relationship between their 3D feature variations and each participant's perceptual responses. This enables a data-driven examination of the facial features that drive subjective social judgments in individual participants, thereby providing a critical explanatory element in understanding human social perception (see Jack & Schyns, 2017, for a review). Further, using a per-participant modelling approach is highly powered, produces statistically robust results, replicates relevant effects across the *N* participants of the sample (where chance replication has low probability; e.g., Ince et al., 2021, 2022; see also Richters, 2021; Speelman & McGann, 2020), preserves (rather than erases) variations of effects across the participants, and enables estimations of their prevalence in the population using Bayesian population prevalence (Ince et al., 2021, 2022).

We used this approach across two separate experiments to model and validate the facial features that drive the subjective perception[2] of (a) social class in 30 individual young, White, Western participants, and (b) four social traits—trustworthiness, dominance, competence, and warmth—central to stereotyping (including of social class) and person perception (e.g., Cuddy et al., 2008; Todorov et al., 2008; Fiske et al., 2007) in a separate group of 30 individual young, White, Western participants. Analysis of the resulting face models showed that social class perception is driven by a specific combination of facial features—faces judged as rich are narrower and longer with protruding features and upturned mouths, and lighter, warmer complexions than those judged as poor. Next, having replicated the finding that perceptions of social class correlate with stereotype-related social traits (Bjornsdottir, 2019; Bjornsdottir & Rule, 2017), we compared the specific facial features driving these related judgements using a complementary combination of Principal Components Analysis (PCA) and machine learning. Results revealed that these related judgments are driven by an underlying set of shared facial features—e.g., facial width, mouth curvature, and complexion lightness and warmth—with social class perception comprising a specific combination of stereotype-related facial features. Thus, our results show that social class judgments are based on facial features that also drive stereotypically related social trait judgments, suggesting that social class perception is embedded with and could be driven by multiple stereotypes.

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[2] Specifically, we examine the facial features that drive *impressions* of social class and traits, rather than any facial features that actually correspond to a person being of a particular social class standing or possessing a particular social trait.

Method

Transparency and Openness

All stimuli, data, and code are available on the Open Science Framework (https://osf.io/w6sv4). This research was not preregistered.

Social Class Perception Experiment

We recruited 30 young, White, native English-speaking British participants (15 females, 15 males; M_{age} = 22.30 years, SD = 3.69 years).[3] All participants had lived in the UK most of their lives with both parents born in the UK, self-reported as middle socioeconomic status (scoring 4–7 on the 1–10 MacArthur scale of subjective social status; Adler et al., 2000; M = 5.45, SD = 1.19), and minimal experience with and/or exposure to non-Western cultures (e.g., De Leersnyder et al., 2011; see Supplementary Online Materials, SOM—Screening Questionnaires).

Figure 1 illustrates the experimental procedure. We generated a set of novel photo-realistic face identities using a 3D generative model of the human face, which is based on high resolution 3D captures of real people (402 total, 232 females, 170 males; M_{age} = 28.19 years, SD = 14.65; 245 White, 149 East Asian, 8 Black) and has a high-fidelity generative capacity to represent the naturalistic variations of typically developed adult human faces (see Zhan et al., 2019a, 2021 for a similar generative model).[4] To generate each stimulus face, the

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[3] Here and in the social trait perception experiment and validation studies, demographic information was collected from participants' participant pool profiles. They reported their sex, nationality, and ethnicity by choosing from a list of options, and age by reporting their date of birth (see SOM).
We based our participant sample sizes on recent data-driven work using similar reverse correlation methods and a per-participant modelling approach (e.g., Zhan et al., 2019a, 2021). Research in social face perception moreover shows high agreement and stable averages for most subjective impressions with a sample of 30 participants (Hehman et al., 2018).

[4] The generative face model comprises a large information space (i.e., 402 identity components for shape and complexion separately) that is based on a diverse sample of real human faces and has a high-fidelity expressive capacity to generate a diverse range of faces (see Zhan et al. 2019a for explicit testing of expressiveness of an earlier version of this generative model).

generative model added random variations of 402 identity components—i.e., variations of 3D morphology and 2D complexion, each represented as Principal Components (PCs; see Figure 1a)—to the model's average White female or male face (aged 18–35 years; see SOM).

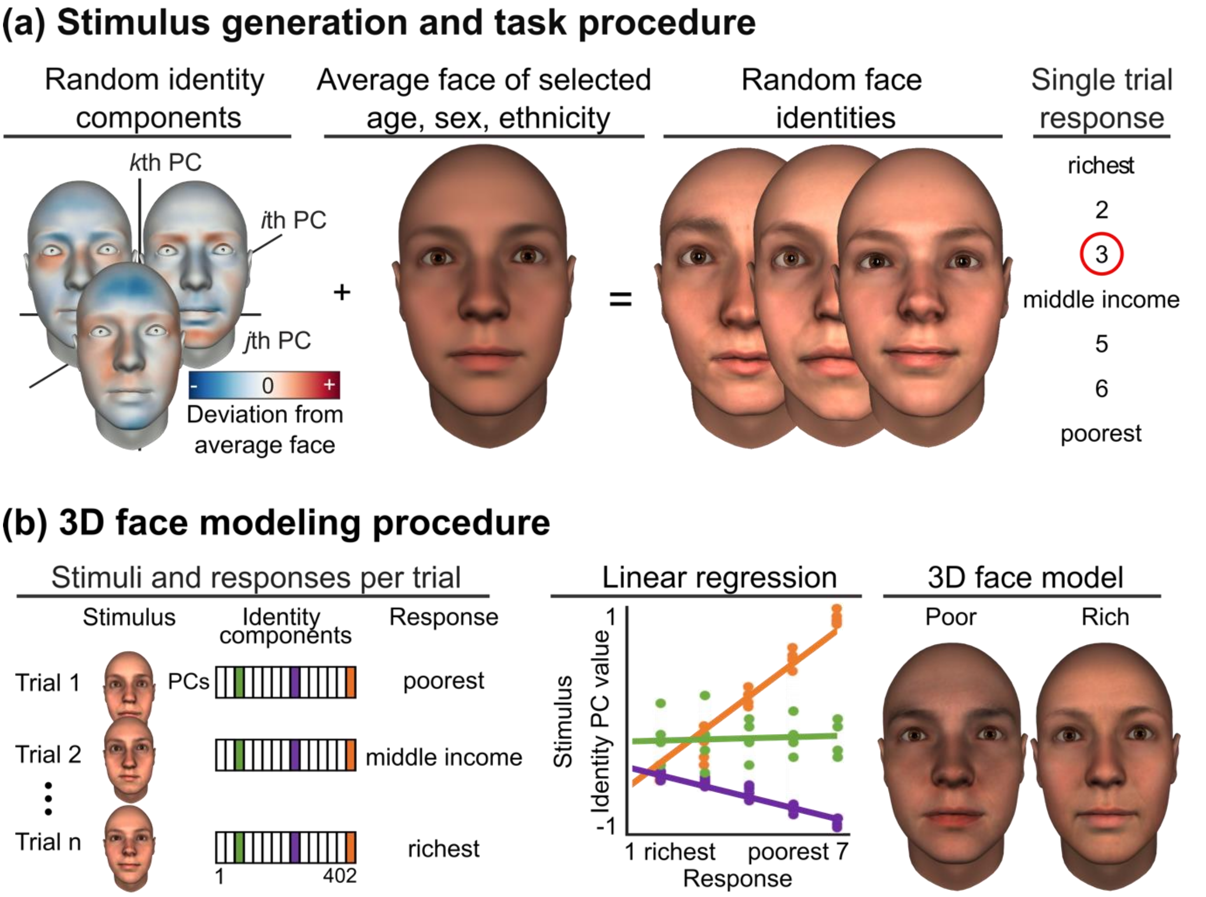
On each experimental trial, participants viewed one randomly generated face (varying in both morphology and complexion) and judged the person's social class standing on a seven-point scale from "richest" to "poorest" with the midpoint labelled "middle income". We chose these labels based on a pilot study showing that British laypeople commonly use the terms "rich" and "poor" to describe the social class spectrum (see SOM— Establishing Commonly Used Social Class Labels for UK Population)[5]. For example, on the illustrative trial in Figure 1a, the participant judged the person to be of above middle income (see red circle). On each trial, we therefore capture the facial features—i.e., 3D morphology and 2D complexion variations—that elicited the perception of a given social class standing in that participant, thus providing an estimate of the internal representations of social class, built from their prior subjective experiences interacting with the external environment (e.g., Dotsch & Todorov, 2012; Gosselin & Schyns, 2003; Tinbergen, 1948). Each of 30 participants rated a total of 2400 randomly generated faces (all White, Western European; 1200 females, 1200 males; aged 18–35 years) in separate blocks for female and male faces (instructions for each block indicated the sex of the face stimuli), with all participants rating the same set of 2400 faces (see SOM for further details).[6]

[5] Extant research also shows that Western perceivers' judgments of different operationalizations of social class from faces, including income, subjective status, and social class category, strongly interrelate and comprise the same latent variable of perceived social class (Bjornsdottir, 2019).

[6] We based the number of trials on previous work using a similar generative model, information sampling space, experimental task, and analytic approach (Zhan et al., 2019a, 2021). Pilot testing also showed that 1200 trials per sex of stimulus face is sufficient to yield statistically robust face models and feasible for participants to complete over several sessions.

Figure 1

Modelling the 3D Facial Features That Drive Subjective Perceptions of Social Class



Note. Panel (a) shows the stimulus generation and task procedure. On each experimental trial, a generative model of 3D human face identity added random face identity components to an average face, thus producing a random face identity. Participants viewed the randomly generated face and rated it according to social class (e.g., see red circle). Panel (b) illustrates the 3D face modelling procedure. To model the facial features that drive the subjective perception of social class in each participant, we regressed the face variations presented on each trial (i.e., the identity component coefficients, color-coded) onto the participant's social class responses. One example participant's poor and rich female face models are shown on the right.

Social Trait Perception Experiment

We recruited 30 young, White, native English-speaking Western participants (15 females, 15 males; M_{age} = 23.77 years, *SD* = 5.03 years) with minimal experience with and/or exposure to non-Western cultures. Participants rated the same set of 2400 randomly generated faces as in the social class perception experiment. On each experimental trial, participants judged the randomly generated face identity according to a given social trait (e.g., submissive/dominant) on a scale from 1 (e.g., "very submissive") to 7 (e.g., "very dominant") with "don't know" as the central response option. Each participant rated the same 2400 face stimuli on each of the four social traits (competence, warmth, dominance, trustworthiness) in separate blocks (also blocked by face stimulus sex) presented in random order across the experiment (see SOM and Hensel et al., in prep.).

Modelling the 3D Facial Features of Social Class and Social Trait Perception

Following the experiment, we derived a 3D model of the facial features that elicit subjective perceptions of social class or social traits in each participant by measuring the statistical relationship between the 3D face morphology and 2D complexion variations presented on each trial—i.e., the 402 identity component coefficients (see Figure 1b, left panel)—and the participant's corresponding ratings, using linear regression (see Figure 1b, center panel, and SOM).[7] Specifically, for each of the 402 identity components, we regressed the stimulus identity component coefficient onto each participant's responses. We replicated this analysis procedure for each individual participant, for each sex of stimulus face, and for 3D morphology and 2D complexion separately, resulting in 300 face morphology and 300 face complexion models (30 participants judging rich/poor × 2 sexes of stimulus face + 30 participants judging 4 social traits [trustworthy/untrustworthy; dominant/submissive; competent/incompetent; warm/cold] × 2 sexes of stimulus face). Figure 1b (right panel) shows one example participant's resulting face models of a rich and poor female face.

Face Model Validation

Next, we validated the 300 face morphology and 300 face complexion models. For the face morphology models, we recruited a new sample of participants (social class: White, British, 10 females, 10 males; M_{age} = 22.80 years, *SD* = 3.49; social traits: White, Western,

[7] For the social trait judgments, we excluded trials with "don't know" responses (16.56% of all trials) before this step.

20 females, 20 males; M_{age} = 23.21 years, *SD* = 4.27 years) who viewed pairs of faces representing different levels of social class (or a social trait), generated from the same individual model, and judged which of the two faces looked richer/poorer or more of each social trait (e.g., which face looked most [un]trustworthy). We retained the 284 (56 social class, 56 competence, 59 warmth, 60 dominance, 53 trustworthiness) 3D face morphology models that participants selected at above chance accuracy (ts ≥ 3.05, corrected ps ≤ .02). For the face complexion models, we used a leave-one-out cross-validation approach to test whether the complexion features of each individual participant model could be correctly classified (i.e., as rich or poor) based on the complexion features derived for all other participant models. We retained the 267 (47 social class, 51 competence, 57 warmth, 57 dominance, 55 trustworthiness) 2D face complexion models that exceeded the significance threshold for further analysis (ρs ≥ .08, corrected ps < .05). On average, 92% of models passed the validation step (see SOM and Figure S1).

Results

Visualizing the Facial Features of Social Class and Social Trait Perception

To reveal the facial features that drive social class and social trait perception, we objectively compared each validated face model to the average White female or male face (18–35 years) derived from the generative face model used to produce the face stimuli. Specifically, for each individual face model, we used their regression parameters to derive predicted identity component coefficients and converted them to vertex values (x, y, and z coordinates) for 3D morphology and to pixel values in L*a*b space for 2D complexion. We then computed the difference between these predicted values and those of the average face from the generative face model, thus producing residuals. For 3D morphology, we derived the 3D residuals vertex-by-vertex using Euclidean distance. For 2D complexion, we used a similar approach for L (luminance), a (green-red), and b (blue-yellow) color plane separately.

We modelled morphology and complexion separately to examine the contribution of each to perception.[8]

Figure 2a shows the results for social class, averaged across participants (shown for convenience vs. displaying all individual models; see also Figure S2 for average social trait face models). Note that we observed high agreement across individual participant models for most facial features (see Figure S3 showing replication of results across participants), demonstrating that the effects observed exceed the population prevalence threshold (n = 8). For brevity, we show results for female faces only as results do not vary substantially by sex of stimulus face (see Figure S4 for social class male faces). As shown by the color-coded face maps, social class judgments are driven by specific facial features. Faces judged as rich are narrower, longer, and more protruding, with upturned mouth corners, raised brows, more closely spaced eyes, and lighter, warmer skin tones. In contrast, faces judged as poor are wider, shorter, and flatter, with downturned mouth corners, lowered brows, and more widely spaced eyes, and darker, cooler skin tones (see also Figure S5 for morphology results separated into x, y, z planes).

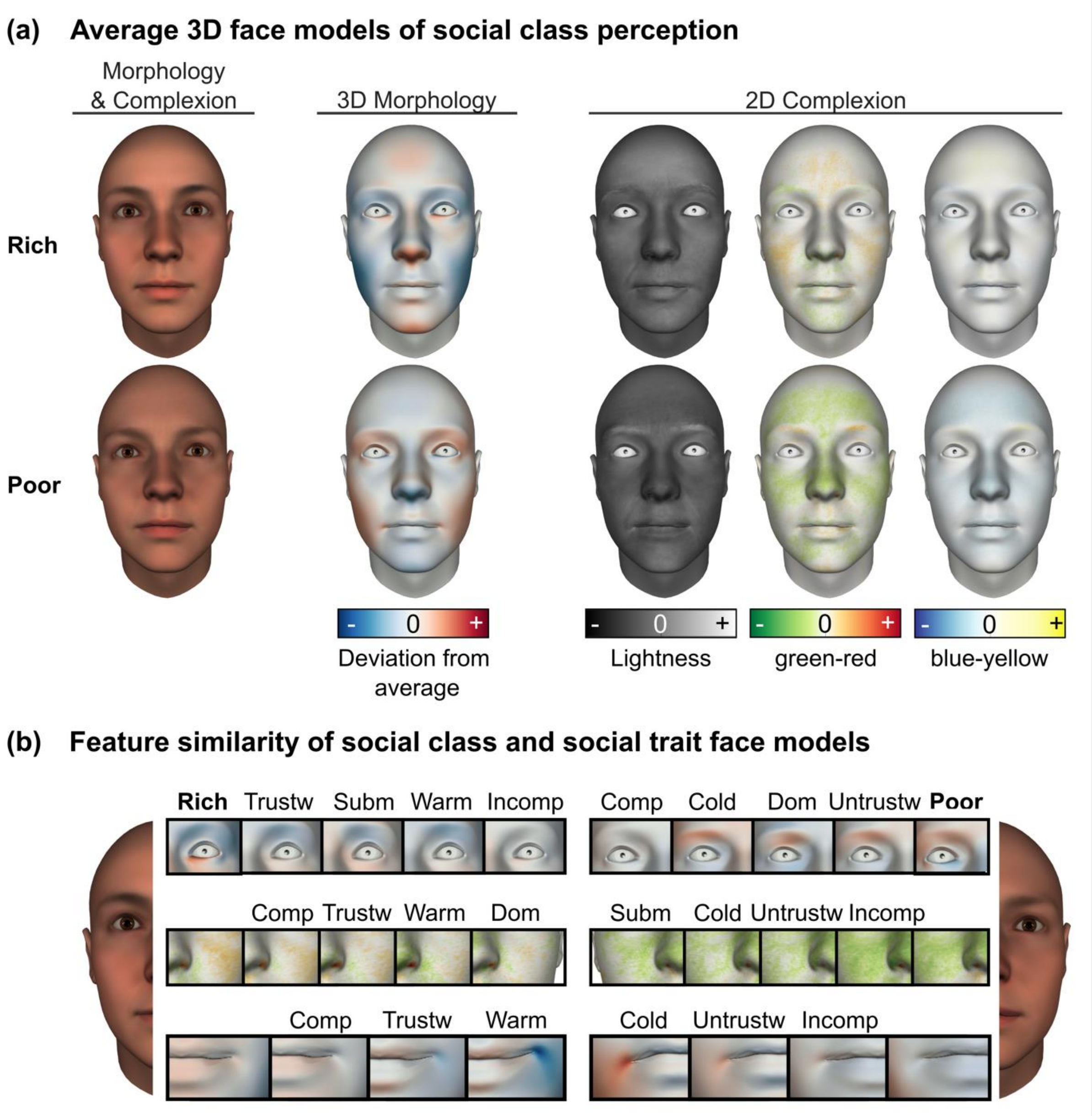
Before comparing the social class and social trait face models, we first replicated the finding that perceptions of social class from the face correlate positively with perceptions of competence, warmth, and trustworthiness, rs(2398) ≥ .51, ps < .001, and weakly negatively with dominance, r(2398) = -.06, p = .004 (social class judgments reverse-coded such that higher numbers represent 'richer' participant ratings; see SOM and Figure S6; Bjornsdottir 2019; Bjornsdottir & Rule, 2017). Next, a preliminary comparison of the social class facial features with those of the social trait face models revealed clear similarities. Figure 2b shows

[8] The generative model furthermore generated 3D morphology and 2D complexion independently to enable precise control over stimulus features, so our analytic approach mirrors this. Deriving statistically robust models from a feature space combining morphology and complexion would require an infeasible number of experimental trials.

three such examples—eyebrow shape, cheek color, and mouth shape—ordered by similarity to rich or poor face models. For example, faces judged as rich have raised eyebrows, redder cheeks, and upturned mouth corners—features also observed in faces judged as trustworthy, warm, and competent. In contrast, faces judged as poor have lowered eyebrows, cooler cheeks, and downturned mouth corners—features which are also observed in faces judged as untrustworthy, cold, and incompetent. Together, these results suggest that social class perception is driven by a latent set of facial features that also drive the perception of stereotype-related social traits.

Figure 2

Facial Features That Drive Subjective Perceptions of Social Class



Note. Panel (a) shows the average 3D face models of social class perception. Faces on the left show the rich and poor face models, averaged across participants. Morphology: color-coding shows the deviation from the average face in 3D space. Complexion: color-coding shows the deviation from the average face for L*a*b color channels separately (see colorbars below). Values are normalized for morphology and complexion separately for display purposes. Panel (b) shows the feature similarity of social class and social trait face models. Each row shows example facial features of stereotype-related social trait face models—eyebrow shape, cheek color, mouth shape—that are similar to rich (on left) and poor face models (on right), ordered by similarity. See Figure S4 for results for male face models.

Extracting a Common Facial Feature Space of Social Class and Social Trait Perception

To test this formally and directly, we measured the similarity of the social class and social trait face models using two complementary analyses—PCA and a machine learning approach.

Principal Components Analysis

First, to examine the overlap in specific facial features (i.e., what features may be shared between the social class and social trait face models), we applied a PCA to all validated individual participant social class and social trait face models, for morphology and complexion and each sex of stimulus face separately (morphology: female *n* = 141, male *n* = 143; complexion: female *n* = 130, male *n* = 137). Each model is represented as 402 predicted identity component coefficients, derived from the regression parameters, for the extreme ends of each social judgment (e.g., "very [in]competent"; see SOM for details). The PCA results thus represent each individual face model as a pattern of *n* PC scores with each PC (i.e., dimension) representing a specific set of facial features that characterizes the social class and social trait face model. The PCA thus provides a tractable, lower-dimensional common frame of reference to objectively compare the face models (i.e., all face models are projected into the same *n*-dimensional space according to their PC scores; optimal numbers of PCs determined using the broken stick and elbow methods, see SOM and Figure S7). The color-coded matrix in Figure 3 shows for each social judgment, the average (mean across individual face models) PC scores for morphology and complexion separately (see Figure S9 for male faces). Brown represents negative PC scores, teal represents positive scores (see colorbar), asterisks show the PCs that are significantly associated with the face models of that social judgment (assessed using single-sample *t*-tests comparing the PC scores to 0; see SOM).

Dendrograms to the left show the *overall* similarity of the social class and social trait face models, measured as the average pairwise similarities (Euclidean distance) of their average PC scores. Results show clear clustering structure between social class and social traits—rich face models are overall most similar to warm, trustworthy, competent, and submissive face models, whereas poor face models are overall most similar to cold, untrustworthy, incompetent, and dominant face models. However, results also show that rich and poor face models comprise a specific pattern of PC scores (i.e., specific combination of facial features) that do not map directly onto any specific social trait—for example, rich and poor face models are uniquely represented primarily by morphology PCs1–2.

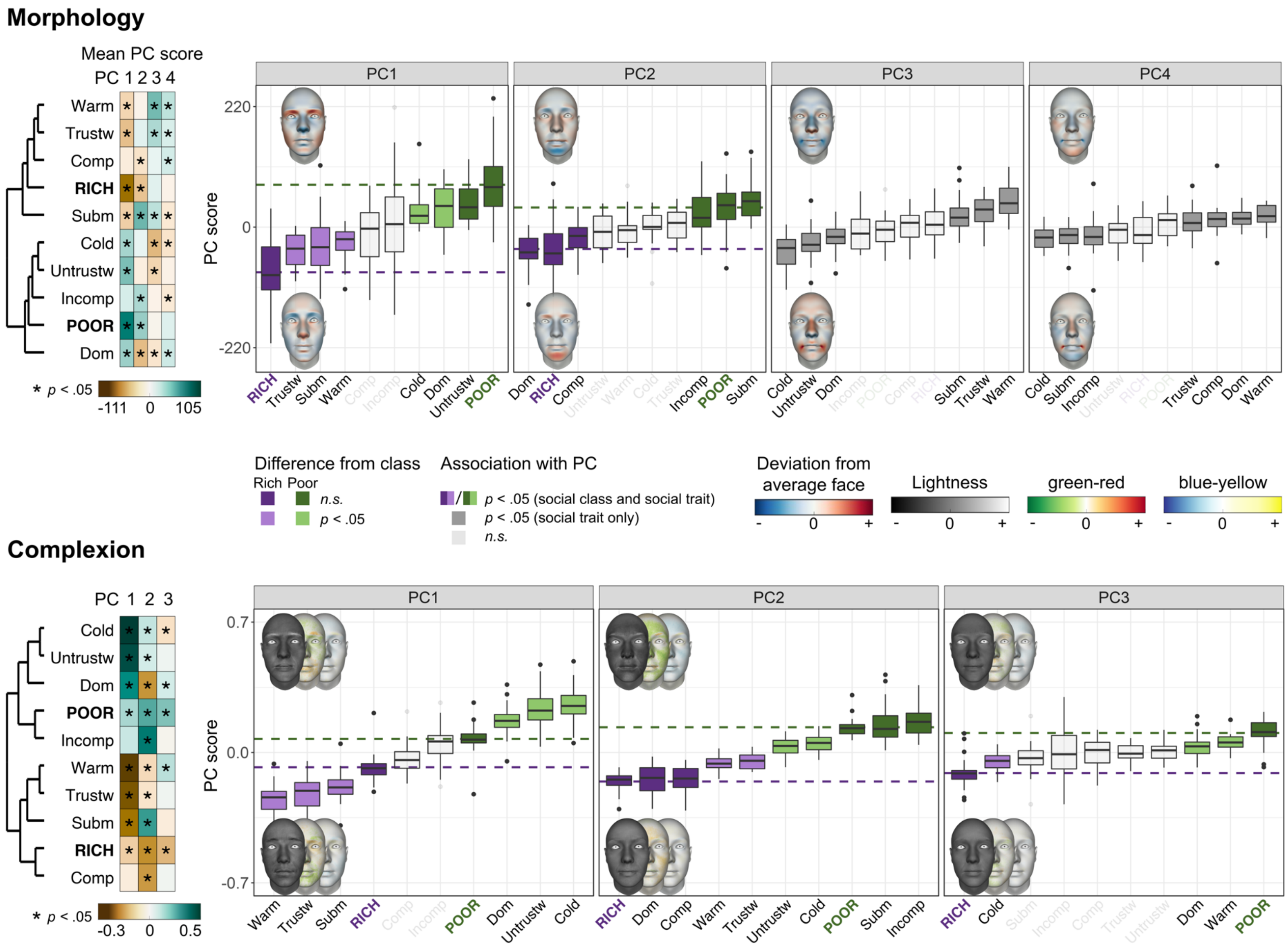
Next, to examine the *specific facial features* underlying these overall similarities (i.e., “respects for similarity,” see Medin et al., 1993), we compared the distributions of the social class and social trait PC scores (significant PCs only, see asterisks in Figure 3 and SOM). Figure 3 shows the results as color-coded box plots for each social judgment, with face maps showing the features represented by each PC (see Figure S8 for morphology PCs shown in x, y, and z planes separately). Purple shows comparisons between social traits and rich face models, green shows comparisons with poor face models; darker tones indicate closer feature resemblance (i.e., no statistically significant difference in PC score distributions), lighter tones indicate that the facial features are more/less pronounced for social class compared to social traits (i.e., statistically significant difference in PC score distributions; Welch two-sample *t*-tests, see SOM). Results show that rich and poor face models comprise a specific combination of facial features that closely resemble those of social traits (dark purple/green) and show more/less feature pronunciation compared to social traits (light purple/green).

Specifically, rich face models comprise features that closely resemble those of dominance and competence face models (dark purple): protruding chin, higher placed mouth, lowered inner eyebrows (morphology PC2), and lighter, warmer complexion (complexion

PC2). Rich face models also include features that are more/less pronounced than those of trustworthy, submissive, and warm face models (light purple): longer and narrower face, upward curved mouth, higher brow, protruding nose (morphology PC1), lighter, warmer eye region, and darker, cooler mouth region (complexion PC1). In contrast, poor face models comprise features that closely resemble those of submissive and incompetent face models (dark green): higher inner brows, lower placed mouth, flatter chins (morphology PC2), and darker, cooler complexion (complexion PC2). Poor face models also comprise features that are more/less pronounced than those of untrustworthy, dominant, and cold face models (light green): lowered eyebrows; shorter, wider, flatter face with downturned mouth (morphology PC1); and darker, cooler eye region; lighter, warmer mouth region (complexion PC1). Together, these results confirm that faces judged as rich or poor comprise a specific combination of stereotype-related facial features.

Figure 3

Comparison of Facial Features Associated with the Subjective Perception of Social Class and Social Traits


Morphology
Mean PC score
PC 1 2 3 4
Warm
Trustw
Comp
RICH
Subm
Cold
Untrustw
Incomp
POOR
Dom
* p < .05
-111 0 105
PC1
PC2
PC3
PC4
PC score
220
0
-220
Difference from class
Rich Poor
n.s.
p < .05
Association with PC
p < .05 (social class and social trait)
p < .05 (social trait only)
n.s.
Deviation from average face
Lightness
green-red
blue-yellow
Complexion
PC 1 2 3
-0.3 0 0.5
0.7
0.0
-0.7

Note. Color-coded matrices on the left show the average Principal Component (PC) scores for social class and social trait face models. Asterisks denote PCs significantly associated with the social judgment ($p < .05$, single-sample t-tests). PC scores are ordered according to pairwise similarity, denoted by dendrogram. Color-coded boxplots to right show the distribution of these PC scores (y axis) for each social judgment (x axis). Each subplot represents a PC; face maps show the facial features captured by each PC. Purple indicates comparison with rich face models; green indicates comparison with poor face models; dark/light tones indicate relative resemblance (using Welch two-sample t-tests). Black dots denote points >1.5 × interquartile range. Horizontal dashed lines show average social class PC scores (statistically significant PCs only). See Figure S9 for results for male faces.

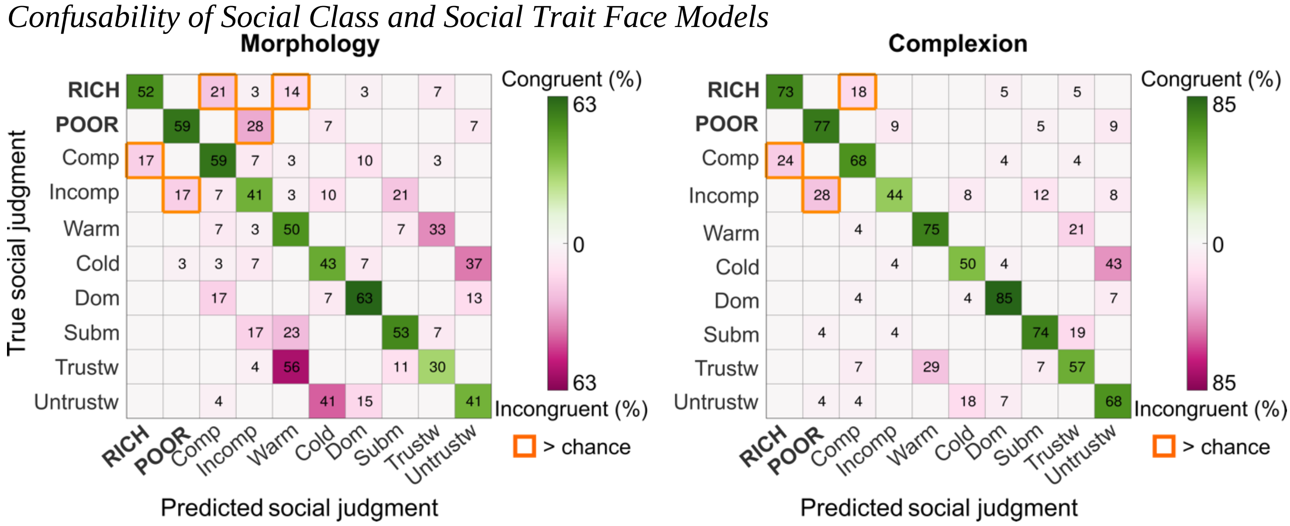
Classification of Social Class and Social Trait Face Models

Next, we tested overall similarity between the social class and social trait models by examining whether social class perception could be explained by any single stereotypically related social trait (i.e., whether one stereotype, vs. multiple stereotypes, could explain the relation between facial features and subjective perceptions of social class). To do so, we used a classifier (support vector machine; SVM) to test confusability of the face models—i.e., overall how similar their facial features are. In a stratified 10-fold cross-validation, we trained the SVM to predict the 10 social judgment labels (e.g., rich, poor, competent, incompetent, warm, cold, dominant, submissive, warm, cold) based on the individual face models (morphology: female n = 141, 27 social class, 28 competence, 29 warmth, 30 dominance, 27 trustworthiness; male n = 143, 29 social class, 28 componence, 30 warmth, 30 dominance, 26 trustworthiness; complexion: female n = 130, 22 social class, 25 competence, 28 warmth, 27 dominance, 28 trustworthiness; male n = 137, 25 social class, 26 competence, 29 warmth, 30 dominance, 27 trustworthiness; each × 2 for the ends of each judgment scale) reconstructed from the PCs derived for morphology (n = 4 PCs) and complexion (n = 3 PCs), separately for each sex of stimulus face (see SOM). Congruent classifications (e.g., rich face models classified as rich, rather than competent or warm) indicate that the social class and social trait face models comprise distinguishable (vs. confusable) combinations of facial features, whereas misclassifications indicate they do not (i.e., are more similar). The color-coded matrices in Figure 4 show the aggregated classifier performance across all folds (see Figure S10 for male faces).

Figure 4 shows the classification performance for morphology and complexion separately. Results show that the social class face models are systematically distinguished from stereotype-related social trait face models (see green diagonal squares) with some systematic misclassifications (off-diagonal squares, orange outlines)—for example, with competence—though these number far fewer than correct classifications. This low confusability between social class and the social trait models indicates that multiple stereotypes (rather than one) characterize the relationship between facial features and social class perception.

Figure 4

Confusability of Social Class and Social Trait Face Models



Note. Color-coded matrices show the performance of a classifier trained on social class and social trait face models for morphology and complexion separately. Green shows congruent classifications (models distinguished), pink shows incongruent classifications (models confused). Squares outlined in orange denote above-chance misclassifications between social class and social traits. Numeric values in each cell show the percentage of face models with congruent/incongruent classifications. See Figure S10 for results for male faces.

Discussion

Here, we examined the facial features that drive subjective judgments of social class, that is, what makes someone look rich or poor, and whether these features correspond to those that drive stereotype-related social trait judgments—e.g., what makes someone look trustworthy or incompetent. Using a perception-based data-driven method, we modelled the 3D facial features that drive the perception of social class in 30 individual young, White, Western participants and four stereotype-related social traits in a further 30 comparable participants. Results showed that faces judged as rich or poor comprise specific combinations of features that reflect several stereotypically-related social traits. Specifically, faces perceived as poor are wider and shorter with flatter and shorter features, downturned mouths, and darker, cooler complexions, whereas faces perceived as rich are narrower and longer, with longer and more protruding features, upturned mouths, and lighter, warmer complexions. We then examined the relationship between these features and those driving judgments of four stereotype-related social traits. Comparison of their facial features showed that social class perception is driven by a specific combination of stereotype-related facial features, suggesting that social class perception is embedded with, and could thus be driven by, multiple stereotypes.

We employed a data-driven approach to model the specific facial features that drive social class perception—i.e., what specific aspects of facial appearance make someone look rich or poor. By doing so, our results go beyond existing approaches that use uncontrolled stimuli and therefore detach these specific facial features from the participants' behavioral responses (see Jack & Schyns, 2017 for a review; Medin et al., 1993; see also Oh et al., 2021; Stolier et al., 2018b). Such approaches cannot objectively demonstrate what specific features the participant is using to make their judgments. We fill this critical gap by experimentally and agnostically manipulating specific facial features and testing their impact on perception. Our results thus provide the missing causal explanation for why certain faces are perceived as rich or poor. We discuss the implications of these results for existing theoretical accounts of social face perception below.

Accounts of human perceptual expertise (e.g., Medin et al., 1993; Schyns et al., 1998; Tanaka & Taylor, 1991) and general communication (e.g., Bradbury & Vehrencamp, 1998; Edelman & Gally, 2001; McGregor, 2005; Shannon, 1948; Tinbergen, 1948) predict that correlated judgments of faces could be driven by shared or different facial features. Our results support the former by showing that social class perception is driven by a specific combination of facial features that also drive stereotype-related trait judgments. This suggests that social class perception is characterized by multiple stereotypes, mirroring existing work that shows a causal link between conceptual or stereotypical associations and social judgments of faces (Bin Meshar et al., 2021; Stolier et al., 2020).

Here, we provide a missing explanatory element to these well-documented perceptual relationships—the specific facial features that drive them. In doing so, our results provide support for current theorizing that the perception of non-obvious (i.e., perceptually ambiguous) social group memberships, such as social class, is based on stereotype knowledge (Bin Meshar et al., 2021—see also their discussion of bidirectionality). That is, perceivers associate specific facial features with central social traits and hold stereotypes associating those traits with social categories, enabling them to use stereotypes to infer social category membership from facial features. Notably, the degree of overlap with different social traits varies: Social class face models overlap most with competence and least with dominance (e.g., rich faces comprise *both* dominant and submissive face features). This aligns with previous research showing that competence is consistently stereotypically associated with social class (e.g., Durante & Fiske, 2017) and could also explain the weak correlation between social class judgments and dominance judgments observed here (see also Bjornsdottir, 2019). Together, our results corroborate the close link between social class and social trait perception (Bjornsdottir, 2019; Bjornsdottir & Rule, 2017) and underscore the strength of social class stereotypes (e.g., Cuddy et al., 2008; Fiske et al., 2007) and of topdown processes (including stereotypes and conceptual knowledge) in person perception (Bin Meshar et al., 2021; Oh et al., 2021; Stolier et al., 2018a, 2018b).

Our results also contribute to the wider literature on face perception, including possible overgeneralization effects (Zebrowitz, 2017; Zebrowitz & Montepare, 2008). Faces judged as poor have features associated with negative attributes, including low fitness—for example, broader faces reflecting higher face adiposity, cooler complexions suggesting poorer health (Henderson et al., 2016; Jones, 2018; Little, 2014; Said & Todorov, 2011; see also Bjornsdottir & Rule, 2017). Faces perceived as poor also include features related to negative affect: downturned mouths typically reflect negative emotions (e.g., Cherbonnier & Michinov, 2021; Ekman & Friesen, 1971; Jack et al., 2012, 2016; see also Bjornsdottir & Rule, 2020, for links between emotion expressions and social class perception). Finally, features of poor-looking faces also overlap with those related to infantilism—for example, shorter chins and lower eyes correspond with infantile features (Berry & McArthur, 1986); as well as unfamiliarity—for example, darker complexions could reflect ethnic outgroups for White perceivers (Blair et al., 2002). Such associations are reflected both in general social class stereotypes, such as competence and well-being (Durante et al., 2017; Varnum, 2013), and in ground truth social class correlates, including mental and physical health (e.g., Adler et al., 1994; Marmot et al., 1991), that laypeople often internalize (e.g., Diener & Biswas-Diener, 2002). Given that manipulating such conceptual associations can influence judgments of faces (Bin Meshar et al., 2021; Stolier et al., 2020), future work should examine whether and how manipulating beliefs about social class could shift perceptions. Such work could inform future interventions to combat biased judgments that can perpetuate inequality.

Finally, our study focused on the perceptions of young, White, predominantly middle-class Western European participants judging young White faces, to control for the potential influence of social class hierarchy differences within and across cultures. Future work should examine social class perception in other cultures, particularly those in which social class stereotypes (e.g., Grigoryan et al., 2020; Schofield et al., 2022) or physical attributes associated with health or beauty may vary (e.g., Zhan et al., 2021). Cultures and groups may also vary in how they define social class (e.g., Cohen et al., 2017; necessitating determining which labels are most appropriate to use, as we did in the current study), and perceiver individual differences, such as own social class standing or degree of class prejudice, could also impact perception. Further, examining the contribution of other-ethnicity and other-age facial features to the perception of social class should also be the focus of future work, given their relevance to social hierarchies and stereotype knowledge (e.g., Brown-Ianuzzi et al., 2017; Freeman et al., 2011; Lei & Bodenhausen, 2017) and impact on first impressions (Xie et al., 2019, 2021). We do, however, anticipate that the general pattern observed here—that social class judgments are driven by facial features that elicit judgments of stereotype-related social traits—would replicate across culture, ethnicity, and age. Similarly, we expect that the broad pattern of results reported here would extend beyond the face to other cues, such as accent and clothing (e.g., see Kraus et al., 2019; Oh et al., 2020). Further, we anticipate finding a similar common featural basis for judgments of other social group memberships (Bin Meshar et al., 2021) and higher-level social judgments more broadly (Stolier et al., 2020). Thus, we expect that the results reported here represent one demonstration of a broader underlying pattern in social perception.

Finally, it is important to highlight that our results relate to the *subjective* perception of social class, rather than the *accuracy* of those perceptions. That is, our results reveal perceivers' beliefs about what people of high and low social class look like but do not necessarily reflect the actual appearance of people of different social classes. We also do not suggest that (static) facial appearance is the only or most important driver of social class perceptions. Future research should examine how other relevant sources of information, such as dynamic facial expressions, clothing, adornments, accent, and context (e.g., Bjornsdottir & Rule, 2020; Hester & Hehman, 2023; Kraus et al., 2019), may interact with facial appearance to drive impressions of social class.

In sum, our results provide new insights into human social face perception by showing that the perception of social class is driven by a specific combination of stereotype-related facial features. These findings align with existing accounts of person perception and provide a critical explanatory element in understanding the link between social class and social trait perception. We anticipate that our approach and results will inform further developments in accounts of person perception.

Constraints on Generality

We recruited young adult White Western participants and used young adult White Western face stimuli in this research to minimize variation between participants due to potential cultural differences in face judgments and to control for stereotypes intersecting social class with other social categories such as race/ethnicity and age. The generative face model we used to produce our stimuli primarily comprised White faces, though validation testing demonstrates that the model has high expressive capacity and fidelity in generating faces of a wide range of ethnicities and ages.

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