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Received: 8 April 2026 | Accepted: 31 October 2026

DOI: 10.1111/bjop.70122

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ARTICLE

# Incidental social category information influences scene evaluation and memory across cultures

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**Abstract**

Visual cognition in naturalistic settings is inherently social, yet much of what is known about social categorisation derives from tasks in which group membership is made explicitly relevant. The present study examined whether social category information influences visual evaluation and memory when it is incidental to the task and embedded within visual scenes, and whether these effects differ across cultures. Two hundred and thirty-one participants from East Asian (China), South Asian (India) and European (United Kingdom and Poland) cultural groups evaluated images depicting either ingroup or outgroup individuals, followed by an unexpected memory test. Racial attitudes and the quality and quantity of intergroup contact were also measured. Images depicting ingroup members were evaluated more positively and remembered more accurately than those depicting outgroup individuals. Memory for images containing outgroup (but not ingroup) individuals was selectively associated with perceived interest. Negative racial attitudes predicted less favourable evaluation of outgroup images, but only among participants reporting lower intergroup contact. There was no evidence that these effects were moderated by participant nationality. Together, these findings suggest that social category information can influence evaluation and memory even when it is task irrelevant, with effects shaped by racial attitudes and intergroup contact.

**KEYWORDS**

cross-cultural differences, incidental memory, ingroup bias, intergroup contact, racial attitudes

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## BACKGROUND

Faces are central to person perception because they provide rapid access to social category information, including identity, age, gender and ethnicity, even under brief or degraded viewing conditions (Rule & Sutherland, 2017; Skorich et al., 2021; Willis & Todorov, 2006). The rapid determination of whether another individual belongs to an ingroup or outgroup has important consequences for subsequent processing. Relative to ingroup faces, outgroup faces are more likely to be processed at a categorical level rather than at an individual level (Levin, 2000; Prunty et al., 2023; Schwartz et al., 2023; Sporer, 2001; Willscheid & Bublatzky, 2024). This bias towards categorical processing has been attributed to differences in perceptual expertise and experience (Hancock & Rhodes, 2008; Tanaka & Pierce, 2009; Valentine et al., 2016), as well as to motivational factors that shape allocation of attention to faces (Hugenberg et al., 2010). Regardless of the underlying mechanism, reduced individuation of outgroup faces results in poorer recognition and memory performance (Bernstein et al., 2007; Hugenberg et al., 2013; Lee & Penrod, 2022; Meissner & Brigham, 2001; Wong et al., 2020). Moreover, categorical processing may also shape evaluative responses, as social category membership can influence trait inferences and affective judgements even when it is not explicitly task-relevant (Ratner et al., 2014; Todorov et al., 2015).

Much of the literature examining ingroup and outgroup face processing relies on tasks in which faces are presented in isolation, with limited or no broader visual or social context (Dotsch et al., 2008; Ratner et al., 2014; Schmid et al., 2022). Although these paradigms have been highly informative, they may inadvertently emphasize the salience of social category membership to participants (Hugenberg et al., 2010; Tracy et al., 2023; Young et al., 2010). It therefore remains unclear whether social category information exerts a similar influence when individuals from the outgroup appear within visual scenes and when category membership is incidental to the task. By incidental, we mean that group membership is not referenced in the task instructions and is not required for task completion. Of course, not being required for task completion does not mean that social information goes unprocessed, and it is the effect of the incidental processing of social information on image evaluation and memory that the present study explores.

The stimuli we consider in the present study are Western-style figurative portraits, which we consider as a structured class of visual scenes rather than as proxies for naturalistic environments. Portraits are a class of images in which compositional structure, stylistic features, emotional tone and implied narrative content can vary substantially, allowing viewers to base their evaluations on multiple visual qualities. Considered as visual scenes, portraits also contain multiple elements that compete for attentional priority, including background settings, clothing, painterly style and narrative cues, such that attention to faces must occur within a broader scene context rather than in isolation. Nevertheless, it is well established that faces function as powerful attractors of eye movements and attention within visual scenes (Bindemann et al., 2010; Birmingham et al., 2009; Cerf et al., 2009), and portraiture is a conventionalized genre in which sitters are deliberately centred and foregrounded. The stimuli used here are therefore best characterized as faces-in-context, occupying an intermediate position between isolated face stimuli and fully naturalistic scenes such as photographs of street environments or social gatherings.

The present study extends beyond face processing itself to explore whether the mere presence of ingroup or outgroup individuals influences image evaluation and subsequent incidental memory for the scene. We build on a series of recent studies in which participants evaluated figurative paintings depicting ingroup or outgroup individuals while their eye movements were recorded (Trawiński et al., 2022, 2024; Trawiński, Zang, et al., 2021). Most importantly for the present study, the request made of a participant to evaluate the liking of paintings can be done without explicitly foregrounding the social identity of individuals depicted in them. If image evaluation and incidental scene memory are nevertheless modulated by the group status of individuals portrayed, this would provide evidence that social category information influences scene processing even when it is not directly relevant to the task.

In their studies, Trawiński et al. (2025) also assessed individual differences relevant to motivational accounts of social perception, including implicitly held racial attitudes and self-reported

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quantity and quality of contact with outgroups. These measures were used to predict eye movements during evaluation of figurative paintings, with particular focus on fixations directed towards depicted faces. Across samples from the United Kingdom (UK) and China, more negative implicit attitudes were associated with increased fixations on outgroup relative to ingroup faces. Critically, this effect emerged only among individuals reporting lower quality contact with the relevant outgroup, consistent with intergroup contact theory (Pettigrew & Tropp, 2006). As overall looking time allocated to paintings did not vary as a function of attitudes or contact, this means that the increased attention to outgroup faces necessarily occurred at the expense of general image exploration. Together these findings indicate that attitudes and intergroup contact shape attention allocation to socially relevant features within complex scenes.

These results may result from the influence of a number of factors. Perceptual expertise accounts attribute outgroup processing costs primarily to reduced experience in individuating outgroup faces (Hancock & Rhodes, 2008; Tanaka & Pierce, 2009; Valentine et al., 2016). On this perceptual expertise account, the quantity of intergroup contact should be the principal moderator, with implicit attitudes carrying little additional explanatory weight. By contrast, socio-motivational accounts, such as the Categorisation-Individuation Model (Hugenberg et al., 2010), predict that viewers individuate those people that they are motivated to individuate. On this socio-motivational account, evaluative attitudes and the quality of individuating experience should interact. Specifically, negative social attitudes should shape responses among individuals whose individuating experience with the outgroup people is limited. Intergroup contact theory (Pettigrew & Tropp, 2006) makes a similar prediction, in that high-quality contact should buffer the behavioural expression of negative attitudes.

As prior research has demonstrated that racial attitudes and social contact shape attention allocation to faces within complex images, the present study addresses two related questions. First, we examined whether factors known to influence eye movements during image evaluation also affect incidental memory for those images by introducing a yes/no forced-choice memory phase. If increased attention to outgroup faces occurs at the expense of broader scene exploration, this attentional trade-off may impair encoding of other image elements and thereby influence subsequent memory performance. Second, we adopted a cross-cultural design to test whether attitudes and social contact influence image evaluation and memory in comparable ways across cultural contexts. Participants were recruited from China, India, Poland and the United Kingdom, while sitters depicted in the paintings were drawn from East Asian, South Asian and White European backgrounds. This cross-cultural design ensured that ingroup and outgroup definitions varied across participant groups, allowing the independent manipulation of participants' ethnicity and the ethnicity of the depicted faces. Evidence of similar patterns across cultures would suggest a broadly general influence of attitudes and social contact on evaluative and memory processes, potentially underpinned by shared mechanisms of perceptual and attentional processing.

The present study extends the prior work (Trawiński et al., 2022, 2024, 2025; Trawiński, Zang, et al., 2021) in three ways. First, eye movements were measured during evaluation in previous studies, but here we focus on performance in an unexpected test of recognition memory. Second, careful selection of the corpus of images allied to testing across four participant groups allows a cross-cultural design whereby each sitter serves as the ingroup for at least one participant group and as an outgroup for the others. This rules out stimulus-specific explanations that previous two-sample designs cannot exclude. Third, the design directly tests whether the interaction between attitudes and contact generalizes beyond the two cultural contexts examined previously.

In sum, the present study explores whether participants holding more negative racial attitudes and reporting lower social contact with outgroups evaluate images depicting outgroup individuals differently from those depicting ingroup members. It also explores whether such individual differences in attitudes and intergroup contact are associated with variation in incidental memory for those images. Finally, it explores whether results hold across cultural contexts. Importantly, these questions are explored in a task where social category information is not emphasized to participants and where faces are embedded in a scene context.

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# MATERIALS AND METHODS

## Participants

Participants were recruited from four national groups: the United Kingdom, Poland, India and China. Eligibility criteria required that participants had completed compulsory education in their country of origin, as previous research indicates that formal schooling influences both familiarity with racial categories and the stability of implicit evaluations (Walker & Hewstone, 2006). The sample size followed the pre-registered sampling plan (https://doi.org/10.17605/OSF.IO/9ZSR2). We aimed to recruit a minimum of 200 participants, at least 50 per country, benchmarked against previous studies in which comparable attitude-by-contact effects were detected (Trawiński, Aslanian, & Cheung, 2021; Walker & Hewstone, 2006, 2008).

The sample included 53 participants from the United Kingdom (30 female, 19 male, 4 non-binary; *M* age = 21.89, *SD* = 7.24), 61 from Poland (40 female, 21 male; *M* age = 23.02, *SD* = 2.00), 60 from China (50 female, 10 male; *M* age = 21.83, *SD* = 2.40), and 57 from India (40 female, 16 male, 1 non-binary; *M* age = 30.30, *SD* = 9.69). All participants self-reported their ethnicity. Specifically, British and Polish participants reported being White European, Chinese participants East Asian and Indian participants South Asian.

The final sample consisted of 220 participants, as data from 11 individuals were excluded from analysis (10 participants were excluded due to below-criterion accuracy in the Multicategory Implicit Association Test and one for incomplete data).

Ethical approval for data collection in the United Kingdom and China was granted by the School of Psychology Ethics Committee at Liverpool Hope University (ID: SEL-17042024-004). Ethical approval for data collection in India was granted by the Institutional Review Board of the ARISA Foundation (ID: 04072024-AF-05), and ethical approval for data collection in Poland was granted by the Institute of Psychology at the John Paul II Catholic University of Lublin (ID: KEBN_22/2024).

## Materials and equipment

### Image stimuli

Ninety Western-style painted portraits were selected, representing three ethnocultural categories: White European, East Asian and South Asian (30 images per category; see Figure 1). Categories were matched for sitter gender (50% female) and estimated sitter age. High-resolution images were selected from Google Image Search and The Royal Collection Trust. The height of each image was standardized at 800 pixels, subtending a visual angle of 21.39° in height. The width of each image ranged from 529 to 698 pixels (*M* = 604.62, *SD* = 38.11), giving visual angles between 14.24° and 18.72° in width. Image size did not differ significantly between categories ($p = .96$).

To ensure that low-level visual properties did not differ across categories, all images were analysed using the imageFluency package (Mayer, 2021). Estimates of contrast, complexity, symmetry, and typicality showed no category differences (all $p$'s > .08; see project OSF page for details: https://doi.org/10.17605/OSF.IO/VQJ7T).

Images of paintings were presented using a 544 mm × 306 mm monitor (screen resolution was 1920p × 1080p; refresh rate 100 Hz). Participants were seated approximately 60 cm from the screen, giving a visual angle of 48.77° × 28.61°.

### Aesthetic responsiveness assessment (AReA)

Individual differences in people's general sensitivity to aesthetic experiences were measured using a 14-item self-report questionnaire (Schlotz et al., 2021). Participants provided their responses on a 5-point scale (1 = never and 5 = very often). Total scores reflect the sum of item responses.

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**FIGURE 1** Example of image stimuli: (a) *Shen Fu-Tsung* by Godfrey Kneller (*Source:* Royal Collection Trust); (b) *Pratap Singh* by Rudolf Swoboda (*Source:* Royal Collection Trust); (c) *Spencer Hamilton* by Francis Wheatley (*Source:* Royal Collection Trust).

## Social contact and individuating experience questionnaire (SC; IE)

The three-part questionnaire was used to assess experience with White/European, East Asian and South Asian individuals (Walker & Hewstone, 2006). The set of social contact items measures the quantity of personal contact with people, and the set of individuating experience items measures the frequency of substantial personal interactions (i.e. quality of the experience; 5 items for each race group). Responses were made on a 5-point scale. For each target group, social contact and individuating experience indices were computed as the mean of all relevant items. Internal consistency was high in all four target groups for both instruments: for social contact, $\alpha$=.75–.94 and for individuating experience, $\alpha$=.88–.98. However, formal measurement invariance across national groups was not assessed. Therefore, comparable reliability estimates should not be interpreted as evidence that the SC and IE measures captured equivalent constructs across samples. The descriptive statistics for the AReA, SC and IE are reported in Table 1.

## Multicategory Implicit Association Test ($IAT_{MC}$)

Multicategory Implicit Association Test ($IAT_{MC}$) was used to assess relative strengths between racial groups and positive evaluation among three racial groups (Axt et al., 2014). The task comprised eight blocks (two practice, six test). A single stimulus appeared on each trial, and participants categorized it as quickly and accurately as possible, with errors requiring correction before proceeding. In the initial practice block (16 trials), positive and negative words were categorized using the 'a' and 'l' keys, respectively. In the second practice block (20 trials), one racial group was paired with positive words on the 'a' key, and the remaining groups with negative words on the 'l' key. The six subsequent test blocks (16 trials each) followed this structure, rotating the positive/target racial group across all pairwise combinations. Block order was randomized such that each racial group served as the target once every three blocks, and participants were randomly assigned to one of eight possible orders. Thus, in every test block, a racial group was paired with positive words on one response key while the two remaining groups shared the other key with negative words. Across the six test blocks, each racial group served as the positively paired category twice. This allowed us to compute the three pairwise D-score contrasts described below.

D scores for each pairwise contrast (White European vs. South Asian, White European vs. East Asian, South Asian vs. East Asian) were computed following Brief IAT scoring recommendations

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**TABLE 1** The descriptive statistics for the measures of aesthetic responsiveness [AReA] as well as quantity [SC] and quality of experience [IE] with East Asian [EA], South Asian [SA] and White European [WE] people across four groups of participants.

| | Mean | *SD* | Min | Max |
|---|---|---|---|---|
| UK | | | | |
| AReA | 42.29 | 10.61 | 20 | 63 |
| SC: EA | 2.22 | 0.90 | 1 | 4.8 |
| SC: SA | 2.41 | 1.08 | 1 | 5 |
| SC: WE | 4.20 | 0.86 | 1.8 | 5 |
| IE: EA | 3.30 | 1.05 | 1 | 5 |
| IE: SA | 3.19 | 1.03 | 1 | 5 |
| IE: WE | 4.13 | 0.73 | 2.4 | 5 |
| Poland | | | | |
| AReA | 42.82 | 8.21 | 29 | 59 |
| SC: EA | 1.29 | 0.66 | 1 | 4.2 |
| SC: SA | 1.16 | 0.48 | 1 | 3.8 |
| SC: WE | 4.76 | 0.39 | 3.2 | 5 |
| IE: EA | 1.43 | 0.85 | 1 | 5 |
| IE: SA | 1.36 | 0.81 | 1 | 5 |
| IE: WE | 4.39 | 0.60 | 2.6 | 5 |
| China | | | | |
| AReA | 37.60 | 6.17 | 22 | 54 |
| SC: EA | 4.46 | 0.77 | 1.2 | 5 |
| SC: SA | 1.21 | 0.43 | 1 | 3.2 |
| SC: WE | 1.18 | 0.48 | 1 | 3.4 |
| IE: EA | 3.96 | 1.20 | 1 | 5 |
| IE: SA | 1.46 | 0.89 | 1 | 5 |
| IE: WE | 1.27 | 0.60 | 1 | 3.2 |
| India | | | | |
| AReA | 48.87 | 10.16 | 25 | 69 |
| SC: EA | 1.67 | 1.06 | 1 | 5 |
| SC: SA | 4.81 | 0.59 | 1.8 | 5 |
| SC: WE | 1.82 | 0.96 | 1 | 4.2 |
| IE: EA | 2.24 | 1.13 | 1 | 5 |
| IE: SA | 4.34 | 0.77 | 1 | 5 |
| IE: WE | 2.34 | 1.21 | 1 | 5 |

(Nosek et al., 2014). Trials >10,000 ms and the first four trials of each block were removed; latencies <400 ms were recoded to 400 ms and latencies >2200 to 2200 ms. For each contrast, the mean latency of blocks pairing Group A with positive words (and Group B with negative words) was subtracted from the complementary pairing, and the difference was divided by the pooled standard deviation. Participants were excluded if more than 10% of responses were <200 ms or >5000 ms, or if accuracy fell below 80%. No participant met the response-latency exclusion criteria. Ten participants were excluded due to low accuracy (UK = 5, Poland = 3, India = 2 and China = 0).

From the three pairwise *D* scores, we computed an aggregate score for each group reflecting its relative evaluation. Each group's score was the mean of its two contrasts (e.g. the White European score averaged White European–South Asian and White European–East Asian comparisons). Because these

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scores are interdependent, their mean is necessarily zero, and positive values indicate more favourable evaluations than the average among the three groups, and negative values indicate less favourable evaluations. Figure 2 shows *D* scores across four groups. For detailed analysis of the *D* scores, see Supplement 1 publicly available at the project OSF page.

## Procedure

The study consisted of three parts completed in a single laboratory session using PsychoPy (Peirce et al., 2019): an evaluation task, an unexpected recognition memory test, and a set of individual difference measures. Participants first viewed 60 images (20 White European, 20 East Asian, 20 South Asian), each presented for 5 s in a randomized order. After each image, they rated it on liking, emotional impact, interestingness, familiarity and self-relevance using 7-point scales (1 = not at all, 7 = extremely). Participants were not informed that they would later complete a memory test. Self-relevance was described to participants as the extent to which the image felt personally relevant and relatable to them. The task instruction made no reference to the group membership of the depicted individuals.

Immediately afterwards, participants completed a yes/no recognition task. On each trial, an image was presented and remained onscreen until response. Participants indicated whether they believed the image had been shown in the first part of the study. The task consisted of 60 trials: 30 targets previously seen and 30 foils not shown earlier, with 20 images from each sitter category (White European, East Asian, South Asian). Target-foil assignment was counterbalanced across participants, and trial order was randomized.

Participants then completed the individual difference measures: the AReA, $IAT_{MC}$, SC and IE. Participants completed the study in a fixed order and were allowed to take self-paced breaks in between the stages. The items in the questionnaires were presented in a fixed order. The individual difference measures were completed after the evaluation and memory tasks so that the IAT and the contact questionnaires could not prime race as a factor in the image evaluation and recognition memory tasks. All questionnaires were administered in English (for UK and Indian sample) or translated into Polish or Mandarin Chinese. We followed a standard translation/back-translation procedure (Brislin, 1970). Specifically, a bilingual researcher first translated all items from the source language. A second bilingual translator, blind to the original items, then back-translated the translated version into the source language. The correspondence between the original and back-translated items was independently

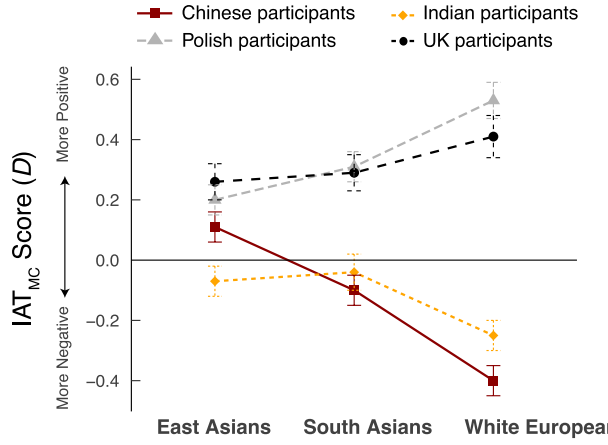



**FIGURE 2** Multicategory Implicit Association Test ($IAT_{MC}$) *D* scores for East Asian, South Asian and White European people. Results are shown separately for participants from China, India, Poland and the UK. Error bars represent the standard error of the mean.

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evaluated for semantic similarity. Items showing discrepancies were iteratively retranslated and revised until agreement was reached. The final item set was approved jointly by the translators.

## RESULTS

The analysis was conducted in three stages. First, we examined the effect of ingroup bias on participants' responses to images. To achieve this, we explored ratings of liking, emotional impact, interestingness, familiarity, self-relevance and memory performance. Descriptive statistics for recognition memory performance (accuracy, hit and false-alarm rates, sensitivity [d'] and criterion [c]) by participant nationality and group status are presented in Table 2. Data were fitted in (Generalized) Linear Mixed-Effects Models [(G)LMMs]. The models consisted of fixed effects of participant nationality (Nationality: UK, Polish [PL], Chinese [CH], Indian [IN]), sitter ethnicity (Sitter: White European [WE], East Asian [EA], South Asian [SA]) and ingroup-outgroup status (Group: ingroup, outgroup). Ingroup-outgroup status was defined with respect to nationality and sitter ethnicity. Specifically, the ingroup was defined as UK-Poland/White European sitters; China/East Asian sitters and India/South Asian sitters. The outgroup was defined by all other combinations.

Nationality and Sitter ethnicity were entered using sum-to-zero contrasts, allowing each coefficient to be interpreted as a deviation from the grand mean. This approach allowed us to explore ratings and memory performance across nationality and sitter ethnicity. To test whether participants consistently evaluated images featuring ingroup sitters more positively than those featuring outgroup sitters, trials were contrast-coded as −0.5 (outgroup) and +0.5 (ingroup), such that the fixed-effect estimate captured the mean difference between ingroup and outgroup trials. Full model outputs for all dependent variables are presented in Tables 3 and 4. Because sum-to-zero contrasts estimate k − 1 coefficients, the deviation for the remaining level (India for Nationality; South Asian for Sitter) was obtained as the negative sum of the estimated coefficients (computed with the emmeans package).

In the second stage of analysis, we explored whether, while controlling for aesthetic responsiveness, racial attitudes towards the extent and quantity of social contact with and the quality of experience with outgroups/ingroups predict any of the set of ratings or memory performance. We assigned the appropriate racial attitudes, social contact and quality of experience score corresponding to the sitter category shown in the image for each participant on each trial. To test the hypotheses laid out in the Introduction, the models included interactions to explore if the extent and quantity of social contact and/or quality of experience with outgroups/ingroups modulate any influence of racial attitudes. Full model outputs for all dependent variables are presented in Tables 5–7.

In the third and final stage of the analysis, we examined whether any of the set of ratings predicted memory performance. Here we considered positive recognition (hits) for target images only, that is, images that had been presented and rated during the evaluation phase. Foil images were not included because they had received no ratings. Separate models were estimated for ingroup and outgroup images because each participant contributed to only one ingroup sitter category but to two outgroup sitter categories. As a result, pooling across group status would have confounded status with the number and composition of trials. The results of these analyses are reported in Table 8, and the association between interestingness and recognition memory is visualized in Figure S1 on the project OSF page.

Data analyses were conducted with R (version 4.4.2). Data were fitted using the *lme4* and *emmeans* packages. The random effects were structured for items and participants, including slopes for those fixed effects that varied within participants or within items and their correlations with the intercepts. The full random structure was trimmed down for those models that did not converge or had a high or equal to zero correlation. For the first stage of the analysis, LMMs were specified with random intercepts for images and participants and random slopes for the Sitter ethnicity, whereas GLMM included random intercepts only. For the second and third stages of the analysis, we conducted random-intercept-only (G)LMMs. These analyses were computed separately for ratings made to the ingroup and outgroups. All continuous predictors were mean-centred and used as predictors in (G)LMMs for

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ingroup and outgroup ratings. The random-effects structure of each model is stated in the note to the corresponding table.

The t/z values equal to 1.96 or higher were interpreted as significant (Baayen et al., 2008). If a significant interaction was found between fixed factors, we explored it further by estimating predicted values and simple slopes of the racial attitude at 1 *SD* above or 1 *SD* below the means of the quantity of social contact or quality of experience. All models and their outputs are available on the project OSF page: https://doi.org/10.17605/OSF.IO/VQJ7T.

## The effect of ingroup bias on ratings and memory performance

The analysis revealed five major findings. First, UK and Polish participants rated images as lower on emotional impact, familiarity and self-relevance relative to the grand mean. Polish participants also rated their liking of the images as lower than the grand mean. Indian and Chinese participants gave higher ratings than the grand mean across emotional impact, familiarity and self-relevance. Indian participants additionally rated the images higher than the grand mean in terms of liking and interestingness, whereas Chinese participants gave lower ratings for these measures. Second, images of East Asian sitters were rated above the grand mean for liking, emotional impact, interestingness, and self-relevance. Images of White European sitters were rated lower than the grand mean on emotional impact, interestingness, and self-relevance. Third, UK participants showed significantly lower, and Indian participants showed higher memory performance relative to the grand mean.

Fourth, and most importantly for the present study, images depicting ingroup sitters were rated as more liked, more emotionally engaging, more interesting, more self-relevant, more familiar and better remembered than images depicting outgroup sitters. Taken together, the results reveal a bias towards providing more positive ratings and better memory for the ingroup, while acknowledging and controlling for cross-cultural variation in nationality differences in overall responding and in responses to sitters from different ethnicities.

Finally, to verify that the ingroup memory advantage reflected differences in sensitivity rather than in response bias, we conducted the accuracy analyses with signal detection scores (Table 2), computed for each participant and sitter category using the log-linear correction (Hautus, 1995; Stanislaw & Todorov, 1999). Sensitivity ($d'$) was significantly higher for images depicting ingroup ($M=2.50$, $SD=1.49$) than outgroup ($M=2.29$, $SD=1.36$) individuals ($d'$: $t(219)=4.96$, $p<.001$, $d_z=0.33$), mirroring the accuracy results (ingroup: $M=.89$, $SD=.23$; outgroup: $M=.87$, $SD=.21$; $t(219)=4.70$, $p<.001$, $d_z=0.32$). A small difference in response criterion ($c$) indicated slightly more conservative responding to ingroup than outgroup images ($M=0.03$ vs. $M=-0.01$; $t(219)=1.98$, $p=.048$, $d_z=0.13$). Importantly, the ingroup memory advantage therefore cannot be attributed to a more liberal tendency to endorse ingroup images as previously seen.

## The effect of racial attitudes, quantity of social contact and quality of experience on ratings and memory performance

### Outgroups

Racial attitudes predicted familiarity, and quantity of social contact predicted self-relevance ratings. Aesthetic responsiveness predicted liking, emotional impact, interestingness, familiarity and self-relevance. No other predictors were significant, including all those involving quality of experience.

There was a reliable set of interactions between quality of experience and racial attitudes (see Figure 3). The influence of racial attitudes on liking, emotional impact and interestingness was evident only for those reporting low quality of contact ($b_{\text{liking}}=0.27$, 95% CI [0.10, 0.44]; $b_{\text{emotional impact}}=0.26$,

**TABLE 2** Descriptive statistics for recognition memory performance: Overall accuracy, hit rate, false-alarm [FA] rate, sensitivity [$d'$] and criterion [$c$] for images depicting ingroup and outgroup individuals, by participant nationality.

| | Accuracy | Hit rate | FA rate | $d'$ | $c$ |
|---|---|---|---|---|---|
| UK | | | | | |
| Ingroup | 0.82 (0.28) | 0.82 (0.26) | 0.18 (0.33) | 2.01 (1.75) | 0.02 (0.42) |
| Outgroup | 0.80 (0.28) | 0.81 (0.27) | 0.21 (0.32) | 1.88 (1.75) | −0.01 (0.39) |
| Poland | | | | | |
| Ingroup | 0.87 (0.24) | 0.87 (0.24) | 0.12 (0.26) | 2.36 (1.60) | 0.03 (0.33) |
| Outgroup | 0.87 (0.22) | 0.87 (0.24) | 0.12 (0.21) | 2.34 (1.39) | 0.03 (0.25) |
| China | | | | | |
| Ingroup | 0.91 (0.22) | 0.90 (0.22) | 0.09 (0.23) | 2.61 (1.49) | 0.06 (0.25) |
| Outgroup | 0.86 (0.19) | 0.88 (0.20) | 0.17 (0.21) | 2.18 (1.26) | −0.06 (0.28) |
| India | | | | | |
| Ingroup | 0.95 (0.13) | 0.95 (0.13) | 0.05 (0.15) | 2.95 (0.91) | 0.01 (0.20) |
| Outgroup | 0.93 (0.13) | 0.93 (0.14) | 0.08 (0.14) | 2.72 (0.90) | −0.01 (0.21) |
| Overall | | | | | |
| Ingroup | 0.89 (0.23) | 0.89 (0.22) | 0.11 (0.25) | 2.50 (1.49) | 0.03 (0.30) |
| Outgroup | 0.87 (0.21) | 0.87 (0.22) | 0.14 (0.23) | 2.29 (1.36) | −0.01 (0.28) |

*Note*: Accuracy is the proportion of correct responses across target and foil trials. Hit and FA rates are proportion scores; $d'$ and $c$ were computed for each participant and sitter category using the log-linear correction and averaged within group status, with outgroup values the mean of the two outgroup sitter categories. Standard deviations are reported in parentheses.

95% CI [0.09, 0.44]; $b_{\text{interestingness}}=0.20$, 95% CI [0.01, 0.39]). For those reporting high quality of contact, there was no significant influence of implicit racial bias on any rating scale (all $p$'s $>.05$).

Relatedly, the influence of implicit racial bias on familiarity was found only among individuals reporting low-quantity contact ($b_{\text{familiarity}}=0.45$, 95% CI [0.29, 0.62]) and not found for those reporting high-quantity contact ($p>.05$).

None of the fixed effects or their interactions predicting incidental memory performance reached significance.

## Ingroups

Racial attitudes predicted liking, interestingness and familiarity, and quantity of contact predicted liking, emotional impact, interestingness, familiarity and self-relevance. Aesthetic responsiveness predicted liking, emotional impact, interestingness, familiarity and self-relevance. No other predictors were significant, including all those involving quality of contact.

No interactions between quality of experience and implicit bias nor quantity of experience and implicit bias reached significance.

The model exploring incidental memory performance failed to converge, preventing reliable interpretation of these effects.

With respect to the outgroup analyses, we re-estimated the LMMs including participant nationality as an additional fixed factor to explicitly test whether the observed interactions generalized across participant groups. In the frequentist models, nationality did not produce significant three-way interactions with racial attitudes and either quality of contact or quantity of contact (all $t$'s $<1.61$). To further evaluate this conclusion, we estimated a Bayesian multilevel model with weakly regularizing priors and compared a model including the three-way interaction between racial attitudes, either quality of contact or quantity of contact, and nationality with a reduced model excluding this term. Inclusion

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**TABLE 3** Linear mixed-effects model results for liking, emotional impact, interestingness, familiarity and self-relevance across group (ingroup, outgroup), Nationality (UK, Polish [PL], Chinese [CH], Indian [IN]) and Sitter (White European [WE], East Asian [EA], South Asian [SA]).

| | Liking | | | Emotional impact | | | Interestingness | | | Familiarity | | | Self-relevance | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***T*** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***t*** |
| (Intercept) | 4.25 | 0.07 | **57.06** | 3.41 | 0.08 | **41.81** | 3.99 | 0.08 | **53.08** | 3.36 | 0.07 | **48.36** | 2.67 | 0.07 | **39.97** |
| Group | 0.13 | 0.04 | **3.16** | 0.31 | 0.04 | **8.61** | 0.10 | 0.04 | **2.38** | 1.30 | 0.05 | **24.22** | 0.62 | 0.04 | **13.92** |
| UK | −0.15 | 0.10 | −1.54 | −0.56 | 0.11 | **−4.87** | −0.19 | 0.11 | −1.80 | −0.57 | 0.11 | **−5.22** | −0.55 | 0.10 | **−5.45** |
| PL | −0.21 | 0.09 | **−2.32** | −0.36 | 0.11 | **−3.36** | −0.04 | 0.10 | −0.38 | −0.49 | 0.10 | **−4.78** | −0.35 | 0.10 | **−3.69** |
| CH | −0.20 | 0.09 | **−2.23** | 0.33 | 0.11 | **3.09** | −0.34 | 0.10 | **−3.32** | 0.39 | 0.10 | **3.73** | 0.23 | 0.10 | **2.43** |
| IN | 0.56 | 0.09 | **6.03** | 0.58 | 0.11 | **5.31** | 0.57 | 0.11 | **5.43** | 0.68 | 0.11 | **6.44** | 0.67 | 0.10 | **6.87** |
| WE | −0.08 | 0.08 | −1.06 | −0.18 | 0.07 | **−2.41** | −0.20 | 0.07 | **−3.04** | 0.09 | 0.06 | 1.51 | −0.15 | 0.06 | **−2.57** |
| EA | 0.17 | 0.07 | **2.29** | 0.17 | 0.07 | **2.33** | 0.14 | 0.07 | **2.19** | −0.07 | 0.05 | −1.33 | 0.15 | 0.06 | **2.57** |
| SA | −0.09 | 0.08 | −1.19 | 0.01 | 0.07 | 0.10 | 0.06 | 0.07 | 0.90 | −0.02 | 0.05 | −0.37 | −0.01 | 0.06 | −0.06 |

*Note*: Significant effects are bolded. The models included random intercepts for participants and images and by-participant random slopes for Sitter ethnicity.



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**TABLE 4** Generalized linear mixed-effects model results for memory accuracy across group (ingroup, outgroup), Nationality (UK, Polish [PL], Chinese [CH], Indian [IN]) and Sitter (White European [WE], East Asian [EA], South Asian [SA]).

| | Accuracy | | |
|---|---|---|---|
| **Predictors** | ***B*** | ***SE*** | ***z*** |
| (Intercept) | 2.77 | 0.13 | **20.71** |
| Group | 0.42 | 0.08 | **5.50** |
| UK | −0.78 | 0.21 | **−3.62** |
| PL | −0.02 | 0.20 | −0.10 |
| CH | −0.11 | 0.20 | −0.52 |
| IN | 0.90 | 0.21 | **4.22** |
| WE | −0.13 | 0.09 | −1.54 |
| EA | 0.14 | 0.09 | 1.64 |
| SA | −0.01 | 0.07 | −0.09 |

*Note*: Significant effects are bolded. The model included random intercepts for participants and images only.

of the three-way interaction did not improve predictive performance ($\Delta ELPD_{liking} = -1$, $SE = 1.5$; $\Delta ELPD_{emotional\ impact} = -2.2$, $SE = 1.7$; $\Delta ELPD_{interestingness} = -2.8$, $SE = 0.6$; $\Delta ELPD_{familiarity} = -1.2$, $SE = 0.3$), with the more parsimonious model favoured.

Because ΔELPD indexes predictive performance rather than evidential support, we additionally computed Bayes factors for the three-way interaction using a Savage–Dickey density ratio evaluated at the joint null for the three nationality contrasts. Under the same weakly regularizing prior used in the Bayesian models, normal(0, 0.5), the evidence favoured the absence of nationality moderation for all four measures ($BF_{01} = 12.5$, 5.2, 28.2, and 5.6 for liking, emotional impact, interestingness and familiarity, respectively). A prior-sensitivity analysis spanning prior widths from 0.25 to 2.0 preserved this direction at every value examined, although with the narrowest prior, the evidence for the null was inconclusive for emotional impact ($BF_{01} = 1.5$) and familiarity ($BF_{01} = 1.4$).

Finally, to quantify the sensitivity of these tests, we calculated the smallest effects that could be detected with 80% power ($\alpha = .05$, two-tailed) for each three-way interaction. The minimum detectable effects ranged from 0.36 to 0.60 rating-scale points, approximately two to four times larger than the attitudes × contact interaction. The analyses were therefore well powered to detect substantial cross-national moderation, but not small differences. Taken together, these results provide moderate to strong evidence that the interaction between racial attitudes and intergroup contact did not differ across the national groups sampled, while leaving open the possibility of effects too small for the present design to detect.

## The relationship between set of ratings and memory performance

Incidental memory for images depicting outgroup sitters was predicted by interestingness. No other fixed effects reached significance for predicting incidental memory of images of either in- or outgroup sitters (Table 8).

# DISCUSSION

The present study explored whether racial attitudes and the quality and quantity of intergroup contact influence the evaluation and incidental memory of images depicting ingroup or outgroup individuals within scenes (hence, with social category information embedded within the scenes). There were five

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**TABLE 5** Linear mixed-effects model results for liking, emotional impact, interestingness, familiarity and self-relevance rating for outgroup images as a function of racial attitudes towards outgroup members [$IAT_{MC}$], quantity of social contact [SC] and quality of experience with outgroup members [IE], and aesthetic responsiveness [AReA].

| | Liking | | | Emotional impact | | | Interestingness | | | Familiarity | | | Self-relevance | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***T*** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***t*** |
| (Intercept) | 4.20 | 0.08 | **49.89** | 3.23 | 0.09 | **36.38** | 3.93 | 0.08 | **46.58** | 2.81 | 0.08 | 34.47 | 2.42 | 0.08 | **31.47** |
| $IAT_{MC}$ | −0.03 | 0.08 | −0.41 | −0.05 | 0.09 | −0.58 | −0.07 | 0.09 | −0.81 | 0.17 | 0.08 | **2.01** | 0.00 | 0.08 | 0.02 |
| IE | −0.00 | 0.03 | −0.02 | −0.02 | 0.03 | −0.78 | −0.01 | 0.03 | −0.50 | −0.01 | 0.03 | −0.52 | −0.04 | 0.02 | −1.75 |
| SC | −0.03 | 0.03 | −1.00 | −0.05 | 0.03 | −1.53 | −0.05 | 0.03 | −1.43 | 0.05 | 0.03 | 1.72 | 0.06 | 0.03 | **2.08** |
| AReA | 0.04 | 0.01 | **6.12** | 0.04 | 0.01 | **5.18** | 0.05 | 0.01 | **7.00** | 0.02 | 0.01 | **2.49** | 0.03 | 0.01 | **4.00** |
| $IAT_{MC} \times IE$ | −0.16 | 0.05 | **−3.18** | −0.16 | 0.05 | **−3.15** | −0.16 | 0.05 | **−2.98** | 0.02 | 0.05 | 0.41 | −0.07 | 0.05 | −1.43 |
| $IAT_{MC} \times SC$ | 0.00 | 0.06 | 0.08 | −0.00 | 0.06 | −0.04 | 0.04 | 0.07 | 0.65 | −0.16 | 0.06 | **−2.71** | −0.04 | 0.06 | −0.79 |

*Note*: Significant effects are bolded. The models included random intercepts for participants and images only.



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**TABLE 6** Linear mixed-effects model results for liking, emotional impact, interestingness, familiarity and self-relevance rating for ingroup images as a function of racial attitudes towards ingroup members [$IAT_{MC}$], quantity of social contact [SC] and quality of experience with ingroup members [IE], and aesthetic responsiveness [AReA].

| | Liking | | | Emotional impact | | | Interestingness | | | Familiarity | | | Self-relevance | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Predictors** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***T*** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***t*** | ***b*** | ***SE*** | ***t*** |
| (Intercept) | 3.43 | 0.22 | **15.72** | 2.72 | 0.26 | **10.61** | 3.04 | 0.23 | **13.02** | 2.91 | 0.30 | **9.83** | 2.29 | 0.26 | **8.92** |
| $IAT_{MC}$ | −0.76 | 0.36 | **−2.10** | −0.66 | 0.43 | −1.51 | −0.81 | 0.40 | **−2.04** | −1.04 | 0.51 | **−2.04** | −0.68 | 0.44 | −1.55 |
| IE | 0.14 | 0.09 | 1.55 | 0.01 | 0.11 | 0.11 | 0.13 | 0.10 | 1.26 | −0.05 | 0.13 | −0.41 | −0.05 | 0.11 | −0.46 |
| SC | 0.33 | 0.12 | **2.77** | 0.46 | 0.14 | **3.28** | 0.39 | 0.13 | **3.04** | 0.63 | 0.17 | **3.83** | 0.45 | 0.14 | **3.16** |
| AReA | 0.03 | 0.01 | **4.43** | 0.03 | 0.01 | **3.91** | 0.03 | 0.01 | **4.95** | 0.04 | 0.01 | **4.01** | 0.02 | 0.01 | **2.74** |
| $IAT_{MC} \times IE$ | 0.25 | 0.18 | 1.40 | 0.32 | 0.21 | 1.51 | 0.37 | 0.20 | 1.86 | 0.21 | 0.25 | 0.82 | 0.15 | 0.22 | 0.72 |
| $IAT_{MC} \times SC$ | 0.20 | 0.22 | 0.93 | 0.24 | 0.26 | 0.90 | 0.14 | 0.24 | 0.58 | 0.48 | 0.31 | 1.56 | 0.36 | 0.26 | 1.36 |

*Note*: Significant effects are bolded. The models included random intercepts for participants and images only.



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**TABLE 7** Generalized linear mixed-effects model results for memory accuracy as a function of racial attitudes towards outgroup people [$IAT_{MC}$], quantity of social contact [SC] and quality of experience with outgroup people [IE], and aesthetic responsiveness [AReA].

| | Outgroup | | |
|---|---|---|---|
| **Predictors** | ***B*** | ***SE*** | ***z*** |
| (Intercept) | 2.71 | 0.17 | **16.35** |
| $IAT_{MC}$ | 0.13 | 0.24 | 0.53 |
| IE | −0.01 | 0.07 | −0.10 |
| SC | 0.05 | 0.09 | 0.56 |
| AReA | 0.02 | 0.01 | 1.45 |
| $IAT_{MC} \times IE$ | −0.09 | 0.14 | −0.66 |
| $IAT_{MC} \times SC$ | 0.02 | 0.18 | 0.11 |

*Note*: Significant effects are bolded. The models included random intercepts for participants and images only.

**TABLE 8** Generalized linear mixed-effects model results for memory accuracy as a function of liking, emotional impact, interestingness, familiarity and self-relevance for outgroup and ingroup ratings.

| | Outgroup | | | Ingroup | | |
|---|---|---|---|---|---|---|
| **Predictors** | ***B*** | ***SE*** | ***z*** | ***b*** | ***SE*** | ***z*** |
| (Intercept) | 1.72 | 0.28 | **6.13** | 2.34 | 0.40 | **5.78** |
| Liking | 0.04 | 0.06 | 0.63 | −0.09 | 0.09 | −0.93 |
| Emotional impact | 0.06 | 0.06 | 1.01 | 0.15 | 0.09 | 1.87 |
| Interestingness | 0.26 | 0.06 | **4.31** | 0.14 | 0.09 | 1.57 |
| Familiarity | −0.03 | 0.06 | −0.56 | 0.06 | 0.07 | 0.82 |
| Self-relevance | −0.03 | 0.07 | −0.37 | 0.07 | 0.09 | 0.83 |

*Note*: Significant effects are bolded. The models included random intercepts for participants and images only.

main findings. First, images depicting ingroup members were evaluated more positively than those depicting outgroup individuals. Second, more negative racial attitudes were associated with less favourable image evaluations of outgroup images, but only among participants reporting lower quality (affecting ratings of liking, emotional impact and interestingness) or lower quantity of contact (affecting ratings of familiarity) with the relevant outgroup. Third, images depicting ingroup members were remembered more accurately than those depicting outgroup individuals. Fourth, for images depicting outgroup individuals, perceived interest was positively associated with subsequent incidental memory performance, whereas this relationship was not observed for images depicting ingroup sitters. Finally, there was no evidence that the interaction between racial attitudes and intergroup contact varied as a function of participant nationality. Importantly, these effects emerged in a task in which social category membership was incidental rather than explicitly task-relevant, indicating that racial attitudes and intergroup contact shape evaluative and mnemonic processing even when category information is not the primary focus of attention.

We begin the discussion with two observations. First, the images used in the present study were Western-style figurative paintings in which depicted individuals were typically positioned centrally, yet neither the evaluative ratings nor the incidental memory task required explicit attention to those individuals. This feature of the design is important, as it underscores that social category membership was incidental rather than task relevant. Nevertheless, a substantial body of research has shown that faces reliably attract attention within paintings (Di Dio et al., 2020; Savazzi et al., 2014; Trawiński, Mestry,

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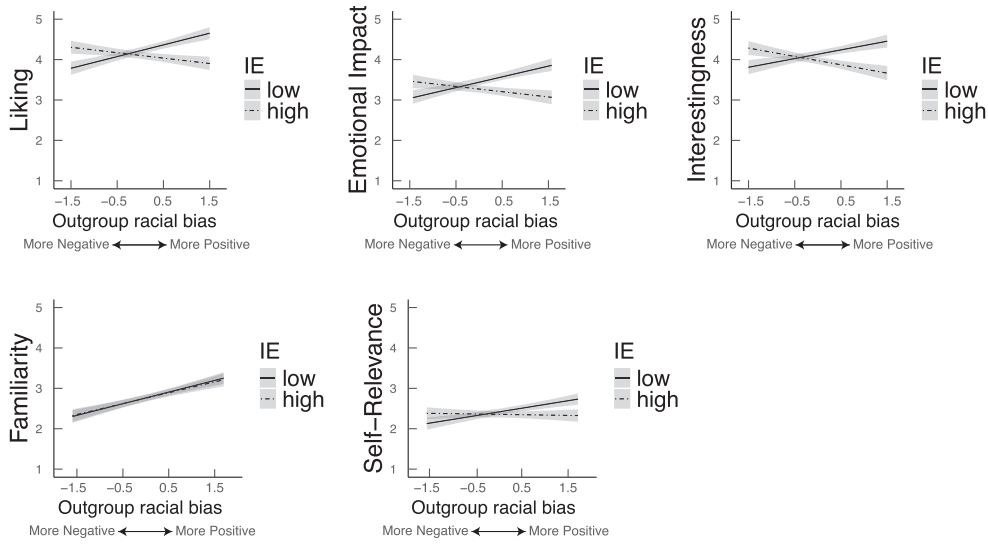



**FIGURE 3** Predicted ratings of liking, emotional impact, interestingness, familiarity and self-relevance as a function of $IAT_{MC}$ *D* scores and participants' quality of experience (IE). Predictions were derived from linear mixed-effects models and plotted using ±1 standard deviation. Lines represent predicted values at low (−1 *SD*) and high (+1 *SD*) levels of IE. Shaded ribbons indicate standard-error bands.

et al., 2021). Although eye movements were not recorded in the present study, the influence of racial attitudes on both evaluative responses and incidental memory performance is consistent with the possibility that participants' attention was preferentially drawn to the faces depicted in the paintings. Such an interpretation accords with prior evidence that socially meaningful facial cues can guide attentional allocation even when they are not directly relevant to the task.

Second, aesthetic responsiveness was positively associated with evaluative ratings of both ingroup and outgroup images, consistent with prior evidence that individual differences in aesthetic sensitivity shape preference responses (Vessel et al., 2013, 2019). This general effect indicates that some participants were more responsive to the aesthetic qualities of the images irrespective of their social content. Importantly, the influence of aesthetic responsiveness on image evaluations was statistically independent of the effects of racial attitudes and both the quantity and quality of intergroup contact. This pattern suggests that the impact of racial attitudes on evaluations cannot be attributed to a general tendency to respond more positively or negatively to images but instead reflects a socially specific modulation of evaluative judgement. Thus, even in a task engaging aesthetic appraisal and sensitivity to socially meaningful facial cues, aesthetic and intergroup influences contributed independently to image evaluation.

Two findings are particularly relevant to incidental image memory. First, images depicting ingroup sitters were remembered more accurately than those showing outgroup individuals. This pattern is consistent with extensive evidence for more efficient processing and individuation of ingroup faces, which typically supports better recognition performance (Levin, 2000; Prunty et al., 2023; Schwartz et al., 2023; Sporer, 2001; Willscheid & Bublatzky, 2024). The signal detection analyses reported above suggest that the ingroup memory advantage reflects greater sensitivity, rather than a shift in decision criterion. If anything, participants were slightly more conservative when judging ingroup images as previously seen. These findings therefore provide little support for a response-bias explanation of the ingroup memory advantage.

Second, incidental memory for images showing outgroup individuals was positively associated with perceived interestingness, whereas no such association was observed for ingroup images. One possible explanation is that when face processing is less efficient, successful differentiation of images relies more heavily on broader scene exploration and encoding of non-facial information. Under these conditions, motivation to engage with the image (indexed here by perceived interest) may facilitate more extensive

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processing and thereby enhance incidental memory. Although the present study did not directly measure gaze allocation, this account is consistent with prior evidence linking face processing expertise to memory performance (Lee & Penrod, 2022; Meissner & Brigham, 2001; Valentine et al., 2016) and demonstrating that visual exploration during encoding plays a functional role in subsequent memory (Henderson et al., 2013; Trawiński et al., 2022; Trawiński, Zang, et al., 2021). As such, the findings suggest that memory for images depicting members of the outgroup may depend more strongly on motivational and attentional factors than memory for images depicting ingroup members. We emphasize, however, that this attentional account is one interpretation among several. Because eye movements were not recorded, the present data cannot decide between attentional, evaluative and decisional accounts of the interest–memory association. Nevertheless, the signal detection analyses place an important constraint on the decisional account of the ingroup-outgroup difference in memory itself.

The absence of a comparable association for ingroup images may have a statistical rather than a psychological explanation. Each participant contributed only one-third as many ingroup as outgroup trials. The ingroup memory model showed convergence difficulties, and near-ceiling ingroup performance restricted the range of the outcome. The power to detect a parallel association for ingroup images was therefore substantially reduced, and the ingroup null should not be over-interpreted. It is also possible that images of outgroup individuals were experienced as more novel or distinctive, and that interestingness ratings partly index this distinctiveness, a property known to drive image memorability (Bainbridge et al., 2013).

Image evaluations were associated with both racial attitudes and intergroup contact, and this pattern differed for ingroup and outgroup images. For images depicting ingroup members, evaluative ratings were positively associated with favourable racial attitudes and with a greater quantity of contact with the ingroup, suggesting that familiarity and positive identification may enhance preference. In contrast, evaluations of images depicting outgroup individuals were negatively associated with racial bias and were moderated by the quality and quantity of intergroup contact. These findings raise an important question regarding the processes through which attitudinal and experiential factors shape evaluative judgements. Specifically, do such effects operate primarily through the affective responses to category membership, through differences in perceptual individuation, or through motivational influences on attention and engagement with the image?

One possible account is that attitudinal and experiential factors modulate perceptual and attentional processes during image viewing. Trawiński et al. (2024) reported data from an eye-tracking study conducted in a museum setting in which participants viewed paintings depicting either White or Black individuals. Participants also completed the measures of implicit racial attitudes (Greenwald et al., 2009) and the intergroup contact (Walker & Hewstone, 2006). Eye movements towards depicted faces were influenced by negative racial attitudes towards Black people, but only among participants reporting lower levels of intergroup contact. Under these conditions, participants fixated more frequently and for longer durations on the faces of Black sitters. Similar patterns were observed in a laboratory study using images depicting White and East Asian individuals, tested with British and Chinese participants (Trawiński et al., 2025), in which negative racial attitudes combined with limited individuating contact were associated with increased attention to outgroup faces across groups.

Although the present study did not record eye movements, these findings suggest that, when viewing images depicting outgroup individuals, participants holding more negative attitudes and reporting lower-quality contact may allocate disproportionate attention to socially salient facial features. Such attentional prioritization could reduce the extent of broader scene exploration, thereby altering the visual information on which evaluative judgements and memory encoding are based. In this way, the influence of racial attitudes on ratings and incidental memory observed here may reflect differences in attentional allocation rather than solely differences in preference response.

However, on their own, differences in perceptual allocation are unlikely to fully account for the present findings. Although visual attention can be systematically related to evaluative judgements, and may both reflect and shape preference (Goller et al., 2019; Pleskac et al., 2023; Schotter et al., 2010; Shimojo et al., 2003), patterns of looking do not uniquely determine why ratings differ. The observed

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evaluation pattern may also reflect attitudinal and social influences on response tendencies. For example, participants reporting more negative racial attitudes and lower-quality contact with outgroup members may be more willing to express negative evaluations of images depicting those individuals, either because they experience weaker social-desirability constraints or because they are less motivated to regulate prejudiced responding (Forscher et al., 2015, 2019; Paulhus, 1991). We did not, however, measure motivation to control prejudice or socially desirable responding, so this account is offered as a direction for future work rather than as an explanation established by the present data. Consistent with evidence that the low quality of intergroup contact is associated with intensified prejudice (Pettigrew et al., 2011; Pettigrew & Tropp, 2006), the present findings, considered alongside prior eye-tracking results (Trawiński et al., 2024, 2025), suggest that negative racial attitudes and limited contact may influence both attentional allocation and the evaluative decision processes engaged when judging images depicting outgroup individuals.

In prior work (Darda & Chatterjee, 2023, 2024), it was also shown that providing contextual information about depicted individuals reduced ingroup bias in aesthetic evaluation among naïve viewers, but not among art experts, suggesting that interpretative frameworks and domain-specific knowledge can attenuate socially driven biases for some observers while leaving others relatively unaffected. This pattern supports the view that the influence of social category membership is not fixed but can be moderated by both informational context and viewer characteristics. In the present study, no additional contextual information was provided, potentially increasing reliance on socially salient cues such as faces.

The context in which individuals are encountered may also shape responses to their group membership. In research on intergroup helping, Borinca et al. (2020) found that outgroup helpers were attributed less empathy and fewer altruistic motives than ingroup helpers, and that recipients were less willing to accept their help. This pattern emerged mostly when help was offered in the recipients' own context, with which outgroup helpers were unfamiliar. Although Borinca et al.'s research explored interpretations of prosocial behaviour rather than visual evaluation or memory, it suggests that responses to group membership may depend on whether individuals appear familiar with, or belong in, the context in which they are encountered. In the present study, sitter category and context were not manipulated independently. Each sitter appeared within the pictorial conventions of the original portrait. Therefore, congruence between sitters and their depicted context was not systematically varied. Future research could manipulate this congruence directly, for example by presenting the same individuals in settings that are culturally congruent or incongruent with their ethnocultural category. If Borinca et al.'s findings extend to visual evaluation, ingroup-outgroup differences in evaluation should be larger when outgroup individuals appear in settings incongruent with their ethnocultural category.

Regardless of the precise mechanisms involved, there is no evidence that the interaction between racial attitudes and intergroup contact varies as a function of nationality. This finding is important for two reasons. First, at the level of experimental control, it reduces the possibility that the observed effects were driven by stimulus-specific definitions of outgroup and ingroup, as these categories were systematically manipulated across participant groups. Second, by demonstrating comparable associations between attitudinal and social factors and evaluative and mnemonic responses in participants from the UK, Poland, China and India, the findings suggest that similar processes operate across culturally distinct contexts. Although caution is warranted in making strong claims of universality, the results point towards broadly shared influences of intergroup attitudes and intergroup contact on visuo-cognitive processing of images depicting people. We stress that this conclusion rests on the absence of detected moderation rather than on positive evidence of equivalence (Lakens, 2017). In addition, the four samples studied here, two European, one East Asian and one South Asian, do not constitute a sufficient representative test of cross-cultural generality (Henrich et al., 2010).

Furthermore, previous research has shown that racial attitudes and intergroup contact influence the perceptual responses of isolated faces (Trawiński, Aslanian, & Cheung, 2021; Walker & Hewstone, 2006, 2008). The present findings extend this work by demonstrating that such effects are also evident when faces are embedded within complex visual scenes. Specifically, the racial background of a depicted individual was associated with differences in evaluation and incidental memory for the image as a whole

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despite the face constituting only one element within a broader scene composition. Whatever visual information was available in the paintings beyond faces was not sufficient to compensate for the known influence of racial attitudes and intergroup contact on perceptual responses to isolated faces. The results are consistent with the possibility that the presence of an outgroup face functions as a salient social cue that guides attention and shapes interpretation at the level of the entire scene. Thus, the influence of racial attitudes and intergroup contact appears not to be confined to perceptual responses to isolated faces but extends to evaluative and mnemonic processing of complex images.

Although the influence of racial attitudes and intergroup contact on evaluation and incidental memory did not differ across groups of participants, baseline differences in scale usage were observed. Participants from the UK and Poland tended to provide lower overall ratings, whereas participants from India and China generally gave higher ratings across several evaluative metrics. In addition, the ethnicity of the depicted individuals was associated with systematic differences in baseline evaluations, with images of East Asian sitters receiving more positive ratings than those depicting White European sitters on some measures. These baseline shifts may reflect cultural differences in response styles or evaluative norms (Harzing, 2006; Heine et al., 2002), rather than differences in the processes of interest. Importantly, however, these variations in overall rating levels were independent of the effects of racial attitudes and intergroup contact, indicating that the central findings cannot be attributed to simple cross-cultural differences in scale use. More generally, reference-group effects imply that participants in different countries may anchor their ratings to different implicit standards, such that numerically comparable interaction effects could, in principle, operate on psychologically different regions of the response scale (Heine et al., 2002). Because our central analyses concern within-participant contrasts between ingroup and outgroup images, and because all continuous predictors were mean-centred, such baseline shifts are unlikely to have produced the observed interactions. Nevertheless, comparisons of absolute rating levels across national groups should be interpreted with caution.

Several limitations should be acknowledged. First, the samples were opportunity samples of predominantly young adults, and the study included two European samples, one East Asian sample, and one South Asian sample. The findings therefore speak to generality across the contexts sampled rather than to universality (Henrich et al., 2010).

Second, the social contact and individuating experience measures showed generally high internal consistency within each national group, but measurement invariance across groups was not assessed. Similar levels of internal consistency do not demonstrate that the measures captured equivalent constructs or had equivalent measurement properties across samples (Putnick & Bornstein, 2016). Therefore, the absence of nationality moderation of the attitudes by contact interaction should be interpreted considering this limitation.

Third, although all participants self-reported an ethnicity consistent with their assigned ingroup category, our design equated ingroup status with membership of a broad ethnocultural category. It did not measure the strength of participants' identification with it. For example, Polish and British participants who share a White European category may nevertheless identify with it in culturally distinct ways. In our study, ingroup status was analysed within participants, and because the moderation analyses found no evidence that the effects differed between the Polish and UK samples, such differences are unlikely to account for the present findings. Nevertheless, measures of ingroup identification (Leach et al., 2008) would allow this assumption to be tested directly in future work.

Fourth, the tasks were completed in a fixed order, with the individual difference measures administered last so that they could not sensitize participants to group membership before the evaluation and memory tasks. The converse possibility, that completing the evaluation task influenced subsequent IAT performance, cannot be excluded. Fourth, foils in the recognition test were drawn from the same sitter categories and stylistic pools as targets but were not matched to targets on an item-by-item basis, so recognition decisions may have drawn partly on low-level or stylistic image features. The signal detection analyses reported above indicate that the ingroup advantage reflects sensitivity rather than response bias, but they cannot identify which image features supported discrimination. Finally, Western-style

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portraiture constitutes a conventionalised class of scene, and generalization to other naturalistic scene types, such as photographs of everyday social environments, remains to be tested.

Taken together, the findings clarify how social category information shapes both evaluative judgement and incidental memory for images showing people. Crucially, the behavioural consequences of negative racial attitudes were moderated by the quality and quantity of intergroup contact, indicating that the impact of social bias on visuo-cognitive processing is contingent on intergroup contact. Accordingly, the results reduce concerns that the observed effects reflect explicit priming of social category membership. Instead, they suggest that social category information influences evaluation and incidental memory for complex images even when category membership is task-irrelevant, highlighting the pervasive role of intergroup attitudes in shaping responses to visual scenes.

## AUTHOR CONTRIBUTIONS

**Tobiasz Trawiński:** Conceptualization; methodology; data curation; investigation; formal analysis; visualization; project administration; writing – original draft; writing – review and editing; validation. **Kohinoor Monish Darda:** Conceptualization; writing – review and editing. **Magdalena Szubielska:** Conceptualization; writing – review and editing. **Chuanli Zang:** Conceptualization; writing – review and editing. **Letizia Palumbo:** Conceptualization; writing – review and editing. **Nick Donnelly:** Conceptualization; writing – review and editing.

## ACKNOWLEDGEMENTS

The authors wish to thank Jomkhwun Thongprasong, Shriya Parekh and Junwei Zhao for their help with data collection.

## CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

## DATA AVAILABILITY STATEMENT

Preregistration: The hypotheses and methods were preregistered (https://doi.org/10.17605/OSF.IO/9ZSR2) on 17 April 2024, prior to data collection, which began on 23 April 2024. Data: All data and analysis scripts are publicly available (https://doi.org/10.17605/OSF.IO/VQJ7T).

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**How to cite this article:** Trawiński, T., Darda, K. M., Szubielska, M., Zang, C., Palumbo, L., & Donnelly, N. (2026). Incidental social category information influences scene evaluation and memory across cultures. *British Journal of Psychology*, *00*, 1–23. https://doi.org/10.1111/bjop.70122

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