Article

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Social Class, Sex, and the Ability to Recognize Emotions: The Main Effect is in the Interaction

Susan A. Brener[1], Willem E. Frankenhuis[2,3], Ethan S. Young[2], and Bruce J. Ellis[1]

Abstract

Previous research has demonstrated an inverse relation between subjective social class (SSC) and performance on emotion recognition tasks. Study 1 ($N = 418$) involved a preregistered replication of this effect using the Reading the Mind in the Eyes Task and the Cambridge Mindreading Face-Voice Battery. The inverse relation replicated; however, exploratory analyses revealed a significant interaction between sex and SSC in predicting emotion recognition, indicating that the effect was driven by males. In Study 2 ($N = 745$), we preregistered and tested the interaction on a separate archival dataset. The interaction replicated; the association between SSC and emotion recognition again occurred only in males. Exploratory analyses (Study 3; $N = 381$) examined the generalizability of the interaction to incidental face memory. Our results underscore the need to reevaluate previous research establishing the main effects of social class and sex on emotion recognition abilities, as these effects apparently moderate each other.

Keywords

social class, emotion recognition, social cognition, sex differences

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Emotion recognition is an important skill for successful social functioning throughout the lifespan. Using facial and body cues to discern what others are thinking and feeling is a necessary precursor to more complex social activities, such as building relationships and navigating daily social interactions. Research on emotion recognition skills has been heavily focused on measuring differences between neurotypical and neurodiverse people, suggesting that individuals with conditions such as autism and schizophrenia show deficits in interpreting facial cues (Trémeau, 2006; Yeung, 2021). However, there is substantial variation in emotion recognition abilities in neurotypical adults that can be attributable to numerous factors such as age, sex, culture, and social class (e.g., Kirkland et al., 2013; Kraus et al., 2010; Mill et al., 2009). In this article, we focus on subjective social class and sex in relation to performance on facial emotion recognition tasks.

Previous research has demonstrated a modest but reliable inverse relation between perceived social class—one's subjective impression of their relative position in social hierarchies—and various skills related to paying attention to and accurately inferring the emotions, thoughts, and actions of others. That is, people who perceive themselves as higher in social class tend to display lower empathic accuracy (e.g., worse emotion recognition skills), to be less able to assume the visual perspective of another person, to show worse incidental memory for faces, and to be less adept at signaling their emotions to others than people who perceive themselves as lower in social class (Bjornsdottir et al., 2017; Dietze & Knowles, 2021; Dietze et al., 2022; Kraus et al., 2010; Monroy et al., 2022). Researchers have suggested that these differences may be attributable to the increased interdependence and attention to contextual factors among people in positions of relatively low social status or power (Grossman & Varnum, 2011; Kraus et al., 2010, 2012). Specifically, Kraus and colleagues (2009, 2010, 2012) posit that individuals who have lower social rank have less control over their environment, as other people can disproportionately influence their life outcomes; therefore, people lower in subjective social class should be more likely

[1]University of Utah, Salt Lake City, USA
[2]Utrecht University, The Netherlands
[3]Max Planck Institute for the Study of Crime, Security and Law, Freiburg, Germany

Corresponding Author:
Susan A. Brener, Department of Psychology, University of Utah, 380 S 1530 E Beh S 502, Salt Lake City, UT 84112, USA.
Email: susan.brener@psych.utah.edu

to pay attention to external social factors such as other people's emotions and intentions. Likewise, Dietze and Knowles (2016) propose that people who perceive themselves as lower on the social hierarchy should be more motivated to attend to others' emotions because they see others as being more relevant to achieving their goals.

Importantly, although the term "social class" can encompass both subjective and objective measures, well-powered, preregistered online studies have found that subjective social class more consistently predicts performance on emotion recognition tasks than does objective social class.[1] In these studies, perceptions of relative social rank (i.e., subjective social class) are reliably negatively associated with emotion recognition skills (Bjornsdottir et al., 2017; Dietze & Knowles, 2021). By contrast, online research using objective measures such as educational attainment, occupational prestige, and income (i.e., objective social class) has either found null effects or that people with higher objective socioeconomic status (SES) are better at recognizing and discriminating between emotions (Bjornsdottir et al., 2017; Deveney et al., 2018).[2] These findings, which converge with evolutionary-social psychological models articulating the role of subjective social status in calibrating a range of social behaviors (Kirkpatrick & Ellis, 2001; Mahadevan et al., 2019), indicate that the way a person perceives themselves in social hierarchies may have unique effects on their motivation to attend to the emotions of others, above and beyond their material wealth or resources. Importantly, the unique predictive power of subjective social class, even after controlling for objective social class, has been documented across multiple domains (e.g., self-reported health, psychological well-being, and physical health; Adler et al., 2000; Demakakos et al., 2008; Euteneuer, 2014; Präg et al., 2016; for reviews, see Cundiff & Matthews, 2017; Zell et al., 2018).

In addition to subjective social class, sex has been extensively studied in relation to emotion recognition skills. Several meta-analyses indicate that females tend to have a small advantage over males in identifying nonverbal displays of emotion (Hall, 1984; Kirkland et al., 2013; McClure, 2000; Thompson & Voyer, 2014). This sex difference can be detected as early as infancy (Geary, 1998; McClure, 2000), but tends to be largest in young adults and varies in magnitude depending upon factors such as emotion type (negative vs. positive) and sensory modality (e.g., audio vs. visual; Thompson & Voyer, 2014). Different kinds of explanations have been proposed to account for this sex difference. Sociocultural explanations have focused on socialization of females to be more attentive to the feelings and expressions of others around them (e.g., Brody & Hall, 1993; Sánchez Núñez et al., 2008). Mechanistic explanations have focused on sex-differentiated central neural or peripheral neuroendocrine processes that may support emotion recognition, such as sex differences in oxytocin or hemispheric lateralization (e.g., Kret & De Gelder, 2012; Lee et al., 2009; Leppanen et al., 2017; Shahrestani et al., 2013; Thompson & Voyer, 2014). Finally, evolutionary explanations have conceptualized the female advantage in emotion recognition in functional terms—as a self-protective adaptation that evolved to promote the survival of females and their offspring (e.g., Benenson et al., 2022; Hampson et al., 2006, 2021). All of these explanations remain largely untested, and further theoretical work may be needed to articulate these different hypotheses with adequate precision to render them testable.

Another possibility is that the mechanisms linking sex with emotion recognition are similar to the mechanisms that link social class with emotion recognition. In many modern industrialized societies, females hold fewer positions of power, tend to have lower formal status, and exert less influence over others than do males (e.g., Colarelli et al., 2006; Eagly, 1983; Ragins & Sundstrom, 1989; Smith et al., 2021). There's also evidence that males place greater value on establishing social dominance than do females (Geary, 1998). This lack of status and influence, both formal and informal, may lead to decreased feelings of control over one's life outcomes and increased dependence on others. Thus, females—like individuals inhabiting lower social class positions—may be more motivated to attend to others' emotions as a means of meeting their goals and ensuring their own safety. This parallel between the effects of sex and social class also raises the possibility that these factors may not act independently in shaping emotion recognition skills.

The Current Research

The current research proceeded in three stages (Studies 1–3). Study 1 was part of a larger study of the relations between different types of childhood and current adversity and emotion recognition. For this article, we focus on two confirmatory aims and two exploratory aims of Study 1 relating to social class and emotion recognition. The first confirmatory aim was to conduct a preregistered replication of Dietze and Knowles's (2021) finding that subjective social class is inversely associated with emotion recognition abilities. In accordance with Dietze and Knowles (2021), we measured emotion recognition using the Reading the Mind in the Eyes Task (RMET; Baron-Cohen et al., 2001), which asks participants to infer people's emotions from greyscale pictures of their eyes. Although the RMET has been frequently used in research assessing relations between social class and emotion recognition (e.g., Bjornsdottir et al., 2017; Deveney et al., 2018; Dietze and Knowles, 2021; Kraus et al., 2010), the RMET employs minimalistic stimuli that do not correspond to how emotion expression and perception typically occur in naturalistic social interactions. Therefore, the second confirmatory aim of Study 1 was to test for stimulus generalization. Specifically, we tested for the generalizability of the relation between social class and emotion recognition using more complex, ecologically valid stimuli. To do this, we used the Cambridge Mindreading Face-Voice Battery (CAM; Golan et al., 2006), which presents participants with short silent video clips of full facial expressions of emotions (i.e., facial expressions are communicated through head/facial movements; the target stimuli include the full face and head). The preregistration for Study 1, including study design, planned sample size, exclusion criteria, and planned primary analyses, can be found at https://osf.io/rqesc.[3] For materials, data, and analysis code for all studies, see https://osf.io/tqu9a/.

The first exploratory aim was to test for the interaction between sex and subjective social class in predicting emotion recognition. Subjective social class and sex have each been studied extensively as predictors of emotion recognition; however, as far as we know, interactions between sex and subjective social class in predicting emotion recognition skills have not been tested in previous research. Thus, we explored whether the effects of subjective social class on emotion recognition were moderated by sex; we did not have an a priori prediction regarding the direction of that interaction. The second exploratory aim of Study 1 was to provide a more stringent (unique) test of the relationship between subjective social class and emotion recognition by controlling for objective social class. Additionally, we tested for the interaction between objective social class and sex on emotion recognition. No other exploratory analyses were conducted.

The exploratory analyses in Study 1 revealed a significant moderating effect of sex on subjective social class in predicting emotion recognition. Thus, the primary aim of Study 2 was to conduct a preregistered confirmatory analysis replicating this interaction. Specifically, based on Study 1, we predicted that the effect of subjective social class on emotion recognition would be stronger in males than in females. We conducted this replication using the archival dataset from Dietze and Knowles (2021), focusing on the RMET. Dietze and Knowles (2021) had already established that lower perceived social class predicted better performance on the RMET. We extended their analysis by testing for moderation by sex. The secondary aim of Study 2 was to run an exploratory model testing the relationship between subjective social class and RMET performance while controlling for objective social class. As in Study 1, we also tested for the interaction between objective social class and sex to predict RMET scores. The preregistration, including exclusion criteria and planned analyses, can be found at https://osf.io/p5mcw. For study data, see http://osf.io/z9xta (Dietze & Knowles, 2021).

To further understand our results, additional preliminary analyses were conducted to explore boundary conditions of the observed interaction between sex and social class. The existence of this interaction raises the question of generalizability to other theoretically relevant social-cognitive abilities. Using existing, publicly available data from Dietze et al. (2022), Study 3 examined the potential moderating effect of sex on the relation between social class and an alternative, but theoretically related, outcome variable: incidental face memory. Our goal was to explore whether this relation was stronger in males than in females. As with emotion recognition, social-class differences in incidental memory for faces may arise from differences in motivational relevance (i.e., lower social class individuals should be more motivated to spontaneously remember others' faces because other people are more relevant to achieving their goals; Dietze et al., 2022). For preregistration, see https://osf.io/u4bnc. For study data, see https://osf.io/b3an8/ (Dietze et al., 2022).

Study 1

Method

Participants. Before beginning data collection for Study 1, we conducted a power analysis indicating that a minimum sample size of 308 was required for detecting a correlation of −.17 (observed in Dietze and Knowles's study) with a power of .85. We recruited 438 participants, ages 18 to 35 from the United States using the online platform Prolific Academic (http://www.prolific.co). Before conducting our analyses, we excluded participants who met one or more of the following preregistered criteria: (a) performance below chance on one or both emotion recognition tasks (see "Measures" for more details), (b) nonfluency in English, (c) more than one failed attention item (out of 3), and (d) completion of the entire study in less than 15 minutes. Because we were interested in sex as a predictor variable, we also excluded participants who did not indicate their sex on the survey ($N = 2$; this exclusion criterion was not preregistered). Our final sample size was 418 (222 female, 196 male), with a mean age of 24.03 ($SD = 4.62$); 265 participants identified as White, 25 as Black, 46 as Latino/Hispanic, 39 as Asian or Asian American, and 43 identified as other categories.

Measures

Subjective Social Class. We measured subjective social class with two items. The first item was identical to the social class measure in Dietze and Knowles (2021) and read as follows: "People talk about social classes such as the poor, the working class, the middle class, the upper-middle class, and the upper class. Which of these classes would you say you belong to?" (Jackman & Jackman, 1983). Participants responded on a scale of 1 (*poor*) to 5 (*upper class*). The second item, which was not used in Dietze and Knowles's original analysis, was the McArthur ladder (Adler et al., 2000). This measure presents participants with an image of a 10-rung ladder that represents where people stand in the United States (i.e., the top represents those who are best off, whereas the bottom represents those who are the worst off in terms of money, jobs, and education). Participants are then asked to indicate where they think they stand on the ladder (10 = highest social class, 1 = lowest social class). The two social class items had a correlation of .7 and were standardized and then averaged to create a composite measure of subjective social class. This method of aggregation aligns with Bjornsdottir et al. (2017) and was chosen to increase the reliability and validity of the social class measure.

Objective Social Class. We asked participants to indicate the highest level of education that their mother and father attained[4] (1 = some high school, 2 = GED, 3 = high school diploma, 4 = some college but not college degree, 5 = associate degree, 6 = bachelor's or RN degree, 7 = master's degree, 8 = doctoral or law degree). The composite measure of parental education was an average of mother and father education.

Sex. We asked participants what their sex at birth was (i.e., the sex that appeared on their birth certificate). Response options included "male," "female," "intersex," and "prefer not to answer." Because none of the participants selected "intersex," we coded sex as a binary variable where −1 = male and 1 = female.[5] Participants who chose not to answer were excluded from analyses ($N = 2$).

Emotion Recognition. We measured emotion recognition with two tasks, the first of which was the RMET (Baron-Cohen et al., 2001). The RMET asked participants to look at 36 black-and-white images of eyes that display various complex emotions (e.g., playful, uneasy, interested). All faces in the RMET are White; both male and female faces are used in the task. Below each image was a list of four emotions (participants could display the definitions of the emotion words if they chose). Participants were asked to choose the listed emotion that best described what the person in the picture was thinking or feeling. The task was scored based on the number of correct responses (0–36), where higher scores indicated better emotion recognition. We excluded participants who scored below 25% (i.e., below chance; $N = 2$). The final measure had a mean of 25.89 and a standard deviation of 4.09. To view the RMET as participants saw it, see bit.ly/41Z6GTe.

The second task was the visual portion of the CAM (Golan et al., 2006). The CAM has 50 items and is like the RMET but asked participants to judge emotions of short, moving clips of full heads/faces. The stimuli were in color and included male and female faces representing multiple racial/ethnic backgrounds. As in the RMET, participants were given four emotions to choose from and had the option to display the definitions of each emotion. The score on this task represented the number of correct responses (0–50). Just as with the RMET, we excluded participants who scored below 25% on this task ($N = 2$). The final measure had a mean of 34.90 and a standard deviation of 5.48. To view the CAM as participants saw it, see bit.ly/3J8D0ue

Control Variables. Following Dietze and Knowles (2021), we controlled for age and race as potential confounds in the analyses. Two meta-analyses have demonstrated an effect of age on emotion recognition performance (Gonçalves et al., 2018; Ruffman et al., 2008), and it is well known that race and social class covary (U.S. Census Bureau, 2020). Furthermore, all of the faces in the RMET were White, and there is evidence that people more accurately recognize faces of people whose race/ethnicity matches their own (Elfenbein & Ambady, 2002). Following Dietze and Knowles (2021), we controlled for race using four dummy-coded variables (Black, Latino/Hispanic, Asian, and Other) with White participants as the reference group.

Results

Main Effect of Subjective Social Class on Emotion Recognition (Confirmatory). We tested the main effect of subjective social class on both the RMET and CAM using standard multiple regression. The RMET and CAM were strongly correlated, indicating that they were capturing similar constructs ($r = .56$, $p < .001$; see Supplementary Materials Table S1 for correlations between all Study 1 variables). Consistent with previous research, we found a significant main effect of subjective social class on RMET scores: higher subjective social class was associated with lower scores on the task, after controlling for race and age ($\beta = -.12$, $p = .01$). Adding these covariates, however, did not change the bivariate relationship between social class and RMET scores ($r = -.12$, $p = .01$). Although it was not part of our preregistration, we also found a significant main effect of sex, demonstrating that females performed better than males on average ($\beta = .15$, $p = .003$; see Table 1 for all estimates). Males also showed significantly greater variance on RMET performance than females, Levene's test: $t(416) = 11.55$, $p < .001$; see Supplementary Materials Table S2 for descriptive statistics of all outcome variables broken down by sex.

Similar to the RMET, we found a significant main effect of subjective social class on CAM scores: higher perceived social class was associated with lower scores on the task, after controlling for age and race ($\beta = -.18$, $p < .001$). Again, adding covariates did not meaningfully change the bivariate relationship between social class and CAM scores (bivariate correlation: $r = -.17$, $p < .01$). This finding suggests that the relation between subjective social class and emotion recognition extends to more complex, ecologically realistic stimuli. As with the RMET, we found a significant main effect of sex, with a significant female advantage ($\beta = .28$, $p = < .001$; see Table 2 for all estimates). This effect was not preregistered, but replicates a large body of previous research (see Introduction). Males also showed significantly greater variance on CAM performance than females, Levene's test: $t(416) = 21.22$, $p < .001$.

Interaction Between Sex and Social Class (Exploratory). Given the robust main effects of both sex and subjective social class on emotion recognition, we tested an exploratory interaction between sex and subjective social class for both the RMET and the CAM by adding an interaction term to the original regression models. While testing linear regression assumptions for the models, we discovered that there was

Table 1. Main Effects of Social Class and Sex on RMET Scores (Study 1).

Predictor	β	*B*	95% CI	*p*
Intercept	.00	29.07	[26.85, 31.29]	<.001
Age	–.14	–0.13	[–.22, –.04]	.004
Race (Black)	–.10	–1.80	[–3.44, –.18]	.030
Race (Latino)	–.04	–0.47	[–1.73, .80]	.468
Race (Asian)	.04	0.61	[–.74, 1.96]	.375
Race (Other)	–.03	–0.40	[–1.70, .91]	.551
Sex[a]	.15	0.60	[.20, .99]	.003
Social class	–.12	–0.55	[–.96, –.13]	.010

Note. R^2 = .086, $F(7, 410) = 5.49$, $p < .001$. RMET = Reading the Mind in the Eyes Task; CI = confidence interval.
[a]–1 = male, 1 = female.

Table 2. Main Effects of Social Class and Sex on CAM Scores (Study 1).

Predictor	β	*B*	95% CI	*p*
Intercept	.00	35.56	[32.66, 38.44]	<.001
Age	–.02	–0.02	[–0.14, 0.09]	.708
Race (Black)	–.13	–2.98	[–5.10, –0.87]	.006
Race (Latino)	–.06	–1.01	[–2.65, 0.63]	.225
Race (Asian)	.05	0.94	[–0.81, 2.69]	.293
Race (Other)	–.02	–0.41	[–2.09, 1.28]	.637
Sex[a]	.28	1.54	[1.02, 2.05]	<.001
Social class	–.18	–1.05	[–1.60, –.52]	<.001

Note. R^2 = .141, $F(7, 410) = 9.62$, $p < .001$. CAM = Cambridge Mindreading Face-Voice Battery; CI = confidence interval.
[a]–1 = male, 1 = female.

heterogeneity of error variance between males and females on both the RMET and CAM; specifically, males had greater error variance than females (we return to this finding in the "Discussion" section). To correct for this violation of the homogeneity of variance assumption, we calculated robust standard errors for all estimates (all *p* values reported below are for robust standard errors; Hayes & Cai, 2007).

The exploratory model revealed a significant interaction between sex and subjective social class in predicting scores on the RMET ($\beta = .15$, $p = .003$; see Supplementary Materials Table S3 for all estimates). Specifically, simple slopes analyses revealed that the relationship between social class and emotion recognition was statistically significant for males but not for females (males: $\beta = -.26$, $p < .01$; females: $\beta = .03$, $p = .66$; see Figure 1). Furthermore, at low levels of subjective social class (−1 *SD*), there was no difference in task performance between males and females (slope for sex: $\beta = .00$, $p = .98$); however, at higher levels of subjective social class (+1 *SD*), there was a significant difference between males and females (slope for sex: $\beta = .29$, $p < .01$).

There was also a significant interaction between sex and subjective social class in predicting scores on the CAM ($\beta = .11$, $p = .025$; see Supplementary Materials Table S4 for all estimates). Like the RMET, simple slopes analyses revealed that the relationship between subjective social class and emotion recognition was significant for males but not for females (males: $\beta = -.28$, $p < .01$; females: $\beta = -.06$, $p = .35$; see Figure 2). In addition, the difference in performance between males and females was larger at higher levels of subjective social class than at lower levels of subjective social class (slope for sex at +1 *SD*: $\beta = .39$, $p < .01$; slope for sex at −1 *SD*: $\beta = .17$, $p = .01$).

Controlling for Objective Social Class (Exploratory). As discussed in the Introduction, there appears to be a distinction between subjective and objective social class in predicting emotion recognition. To test for the unique effects of subjective social class on emotion recognition, independent of the effects of objective social class, we added parental education to our main effects model as a proxy for objective social class. Subjective social class and parental education were only moderately correlated ($r = .38$, $p < .001$). Because there was a significant interaction between subjective social class and sex, we also tested for the interaction between objective social class and sex in both models.

Results indicated that for the RMET main effects model, objective social class did not predict task scores ($\beta = .04$, $p = .499$), and adding it to the model did not significantly change the relationship between subjective social class and RMET performance ($\beta = -.12$, $p = .018$). In addition, there

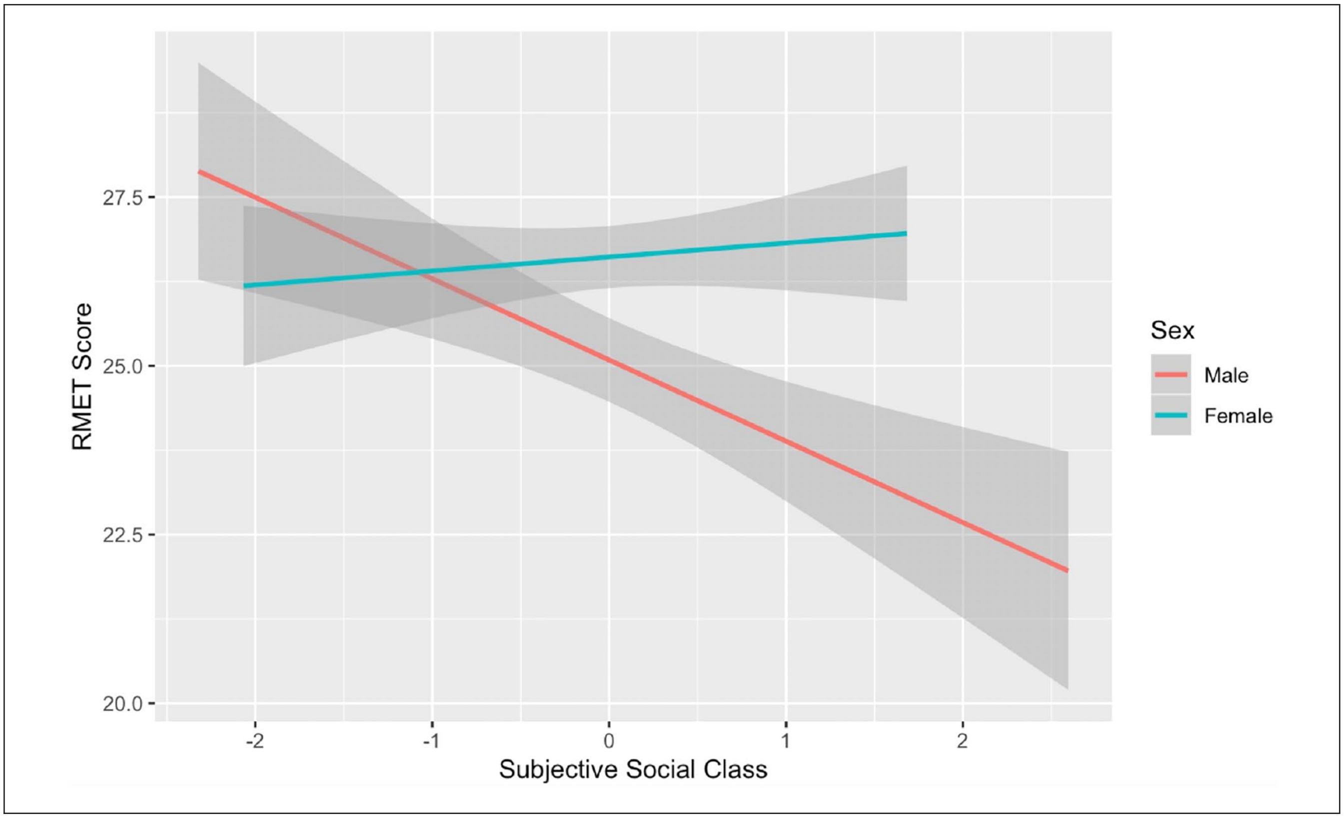

Figure 1. Simple Slopes for Sex by Social Class Interaction: RMET Scores (Study 1).
Note. Error bands represent 95% confidence intervals. RMET = Reading the Mind in the Eyes Task.

was no significant interaction between objective social class and sex to predict RMET scores (β = .15, p = .260; see Supplementary Materials Tables S5 and S6).

The main effects model for the CAM was similar to the RMET in that objective social class did not predict task performance (β = .05, p = .327), and controlling for objective social class did not change the effect of subjective social class (β = −.18, p = < .001). However, there was a significant interaction between objective social class and sex to predict CAM scores (β = .34, p = .015), such that the relationship was negative for males and nonsignificant for females (thus showing the same pattern as the interaction between subjective social class and sex; see Supplementary Materials Tables S7 and S8).

Study 2

Because the sex by subjective social class interaction we found in Study 1 was exploratory, we conducted a preregistered replication of the effect in an independent sample. Study 2 used data from Dietze and Knowles (2021), which was publicly available on OSF. In this sample, the main effects of subjective social class and sex on emotion recognition had already been demonstrated, so we were focused solely on the interaction. We also ran two exploratory models in which we tested for (a) the main effect of subjective social class on emotion recognition while controlling for objective social class and (b) the interaction between objective social class and sex. Because the sample size in Study 2 was predetermined, and substantially larger than in Study 1, we did not conduct any power analyses prior to our analyses.

Method

Participants. The pooled sample of Dietze and Knowles's data consisted of 752 adults aged 18 to 78, recruited from MTurk and Prolific Academic. As in our original study, we removed participants who scored below chance (i.e., below 25%) on the RMET (N = 2) as well as individuals who did not indicate their sex assigned at birth (N = 5; this exclusion criterion was not preregistered). The final sample included was 745 (370 female, 375 male) with a mean age of 34.52 (SD = 11.40); 534 participants identified as White, 63 as Black, 48 as Latino/Hispanic, 42 as Asian or Asian American, and 58 identified as other categories (see Dietze & Knowles, 2021, for more details on procedure and sample).

Measures. Study 2 measures were mostly identical to Study 1, with small differences. Dietze and Knowles (2021)

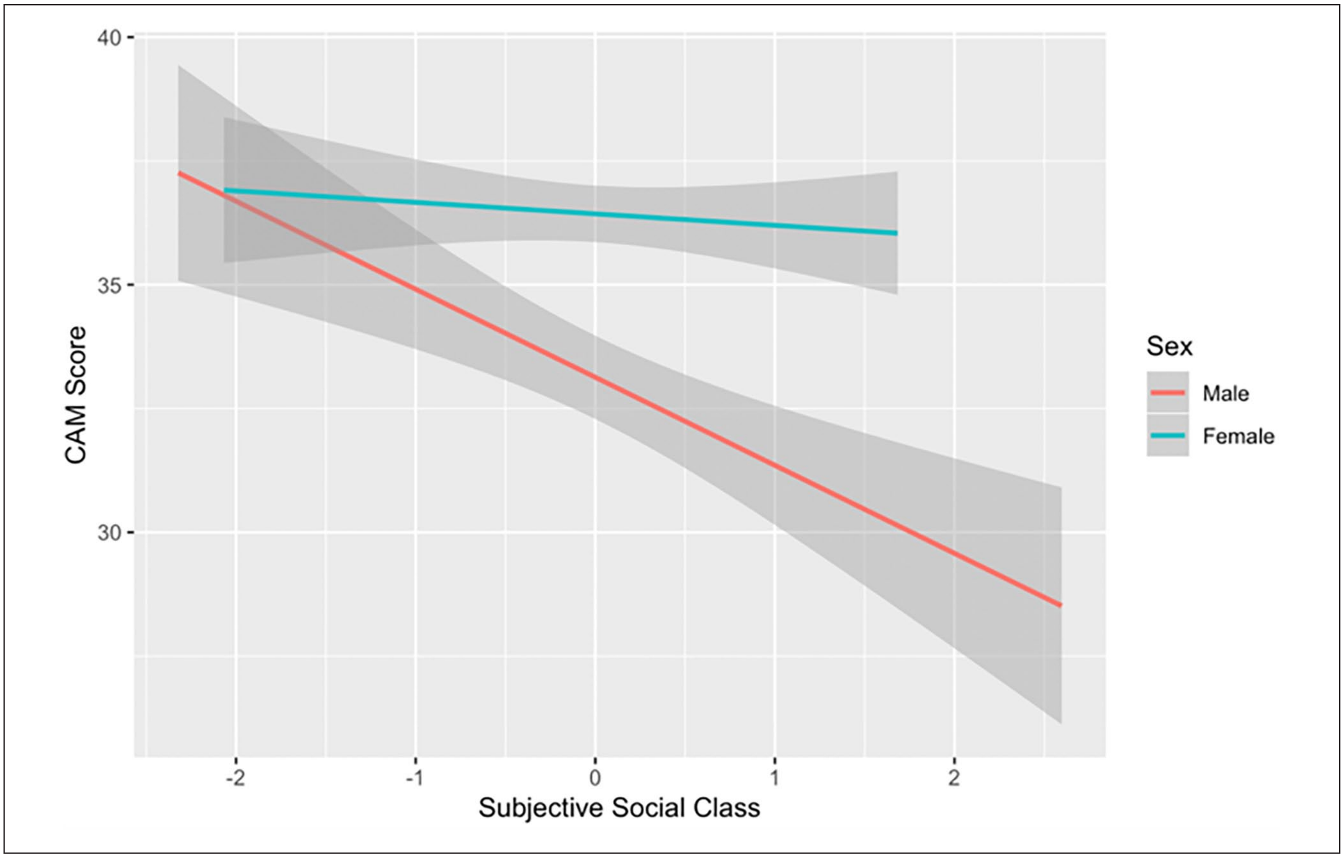

Figure 2. Simple Slopes for Sex by Social Class Interaction: CAM Scores (Study 1).
Note. Error bands represent 95% confidence intervals. CAM = Cambridge Mindreading Face-Voice Battery.

measured emotion perception only with the RMET (not also the CAM). They measured all demographic variables (i.e., sex, race, age) in the same way that we did in Study 1. In addition, they collected measures of mother and father education, which we used as a proxy for objective social class (we used the same aggregation method as in Study 1). They also used the same two questions to assess subjective social class (Adler et al., 2000; Jackman & Jackman, 1983). However, their original analysis only included one of these two indicators of subjective social class (the "poor" to "upper class" question; Jackman & Jackman, 1983). Because Dietze and Knowles collected data on the McArthur ladder item as well, we included it in our subjective social class measure (so as to replicate the analysis from Study 1). In Study 2, the correlation between the two subjective social class questions was .73. The final measure of subjective social class was thus calculated to be identical to Study 1 (an average of the standardized ladder and subjective social class questions).

Results

Interaction Model Replication (Confirmatory). Our model for Study 2 was identical to our interaction model for Study 1; we regressed RMET scores onto subjective social class, sex, and the interaction variable while controlling for age and race. Because we found heterogeneity of error variance between males and females in these data as well, we again calculated robust standard errors for all estimates. The replication model revealed a significant interaction between subjective social class and sex to predict emotion recognition ($\beta = .16$, $p <$ .001; see Table 3 for all estimates). As we predicted, and as is consistent with Study 1, the relationship between subjective social class and emotion recognition was significant for males but not for females (males: $\beta = -.39$, $p < .01$; females: $\beta = -.07$, $p = .15$; see Figure 3). Also consistent with Study 1, there was a significant difference in task performance between males and females at high levels of subjective social class but not at low levels of subjective social class (+1 *SD*: $\beta = .30$, $p = < .01$; −1. *SD*: $\beta = .01$, $p = .79$). As in Study 1, these data also revealed that males had significantly greater variance on RMET performance than females, Levene's test: $t(743) = 28.62$, $p < .001$.

Controlling for Objective Social Class (Exploratory). Just as in Study 1, we ran a main effects model that included parental education as a measure of objective social class as well as a model testing the interaction between objective social class and sex. The models were identical to our models for the

Table 3. Sex by Subjective Social Class Interaction Results for RMET Scores (Study 2).

Predictor	β	*B*	95% CI	*p*	*p* (R)
Intercept	.00	27.01	[25.94, 28.08]	<.001	<.001
Age	.06	0.03	[−0.003, 0.05]	.078	.071
Race (Black)	−.12	−2.05	[−3.19, −0.90]	<.001	<.001
Race (Latino)	.03	0.54	[−0.75, 1.84]	.409	.393
Race (Asian)	−.04	−0.89	[−2.26, 0.49]	.206	.172
Race (Other)	−.08	−1.65	[−3.14, −0.15]	.031	.052
Sex[a]	.15	0.68	[0.36, 0.99]	<.001	<.001
Social class	−.23	−1.17	[−1.51, −0.82]	<.001	<.001
Sex × Social Class	.16	0.79	[0.45, 1.13]	<.001	<.001

Note. R^2 = .136, $F(8, 735) = 14.43$, $p < .001$. RMET = Reading the Mind in the Eyes Task; CI = confidence interval.
[a]−1 = male, 1 = female, (R) indicates *p* value when using robust standard errors.

RMET in Study 1. Subjective social class and parental education were only moderately correlated ($r = .30$, $p < .001$). Results for the main effects model were similar to Study 1 in that (a) objective social class did not predict performance on the RMET ($\beta = -.07$, $p = .073$), and (b) adding it to the model did not change the relationship between subjective social class and RMET scores ($\beta = -.23$, $p < .001$). However, there was a significant interaction between objective social class and sex that mirrored the interaction between subjective social class and sex in the previous analyses ($\beta = .41$, $p = .002$). In other words, the relationship was negative for males and nonsignificant for females (see Supplementary Materials Tables S9 and S10 for estimates).

Study 3 (Exploratory)

The moderating effect of sex (stronger effects in males than females) on relations between social class and the ability to recognize emotions raises the question of generalizability: Does this moderating effect extend to other theoretically relevant social-cognitive abilities? Although this question needs to be addressed in a larger program of research, we conducted a preliminary analysis to explore the generalizability of the moderating effect of sex in the relation to a different but theoretically relevant social-cognitive ability: incidental memory for faces (i.e., spontaneous memory for faces that participants were not asked to memorize). Dietze et al. (2022) found that lower social class was associated with better incidental face memory. In this Study 3, we analyzed publicly available data from Dietze et al. (2022). Due to space constraints, the details of the sample, measures, analysis, and results are reported in the supplement.

To test the moderating effect of sex on the relation between social class and incidental face memory, we ran a moderator analysis that was identical to Dietze et al.'s (2022) original analysis, but added an interaction term between sex and social class. This was preregistered as an exploratory analysis because we did not have an empirical basis for estimating the effect size (of the interaction), which is needed to calculate power. The final dataset included 381 participants aged 18 to 73 recruited through Prolific Academic in the United States.

The moderator analysis indicated that there was not a statistically significant interaction between sex and social class in predicting incidental face memory ($\beta = .07$, $p = .17$; for all estimates, see Supplementary Materials Table S11). However, consistent with Studies 1 and 2, simple slopes analysis revealed that the effect of social class was statistically significant in males ($\beta = -.22$, $p < .01$) but not females ($\beta = -.05$, $p = .38$). That is, social class negatively predicted incidental face memory in males, but not in females. Furthermore, consistent with Studies 1 and 2, there was a significant difference in task performance between males and females at high levels of subjective social class but not at low levels of subjective social class (+1 *SD*: β for sex = .23, $p = < .01$; −1 *SD*: β for sex = .08, $p = .11$).

The lack of a statistically significant interaction between sex and social class in predicting incidental face memory may be due to inadequate power. Given the sample size, the data were only powered to detect a minimum interaction effect size of $\beta = .14$; anything smaller would not reach statistical significance. In total, even though the interaction term was not significant, the pattern and direction of the moderation effect matched the pattern we found in the emotion recognition studies (Studies 1 and 2) and suggests that the interaction could extend to additional tasks. Because these analyses were exploratory, however, we interpret these results with caution. Although the results provide some insight into the possibility that the moderating effect of sex applies to relations between social class and other social-cognitive abilities, we cannot draw conclusions about generalizability at this time (pending additional, appropriately powered replication studies).

Discussion

The research presented here makes several contributions to the existing literature on social class and emotion recognition. In Study 1, we (a) conducted a successful, preregistered

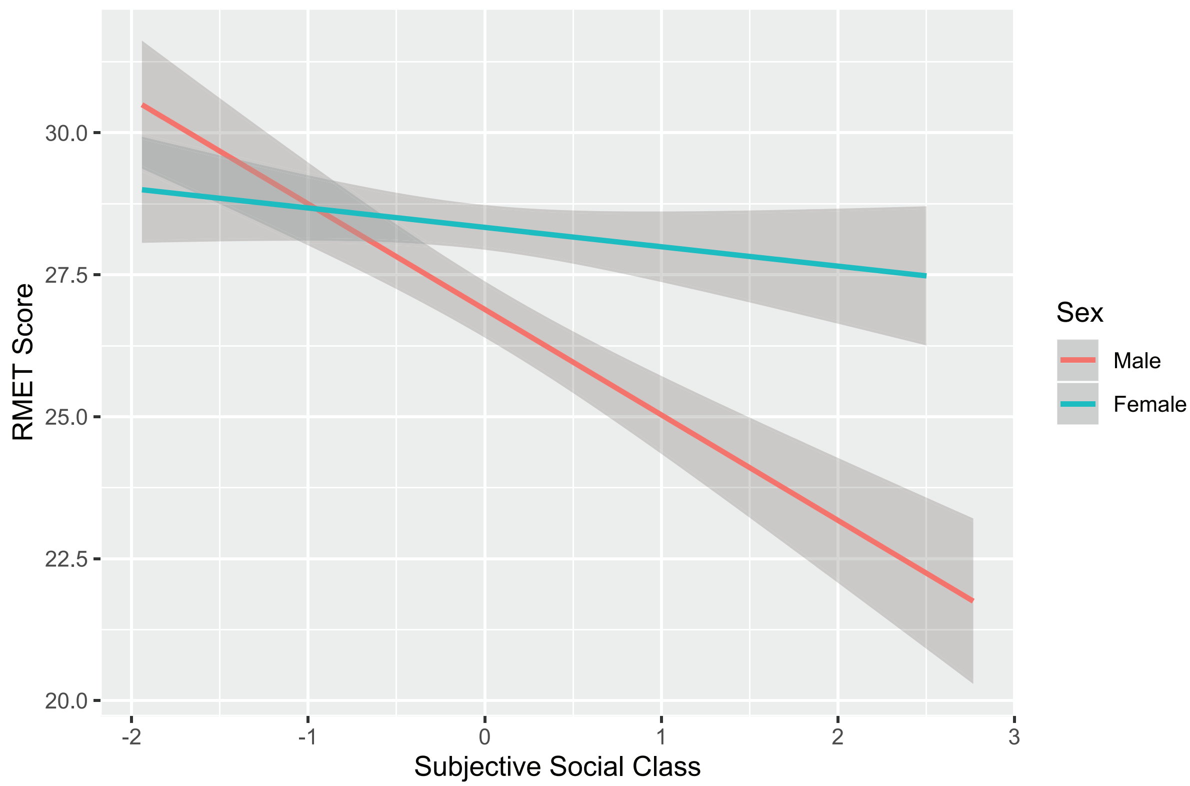

Figure 3. Simple Slopes for Sex by Social Class Interaction: RMET Scores (Study 2).
Note. Error bands represent 95% confidence intervals. RMET = Reading the Mind in the Eyes Task.

replication of Dietze and Knowles's (2021) finding that subjective social class was inversely related to performance on the RMET, and (b) demonstrated that this relation extended to the CAM, which contains more complex, ecologically valid stimuli. Consistent with past research, we also found a significant female advantage on both emotion recognition tasks. These main effects of subjective social class and sex on emotion recognition abilities are now well established. However, exploratory results in Study 1 and confirmatory results in Study 2 indicate that these main effects moderate each other: Variation in subjective social class only predicted emotion recognition performance in males. This interaction suggests that researchers should potentially reconsider the main effects of both subjective social class and sex on emotion recognition, as these factors may not operate independently of one another. Our initial attempt to explore the boundary conditions of this interaction found that, as with emotion recognition abilities, lower social class significantly predicted better incidental face memory in males but not in females; however, the difference between male and female slopes in Study 3 was not statistically significant (as this exploratory study was apparently underpowered to detect the interaction).

Main Effect of Subjective Social Class on Emotion Recognition

Consistent with previous research, we found that individuals who perceive themselves as being higher in the social class hierarchy tend to do worse on emotion recognition tasks than those who perceive themselves as being lower on the hierarchy. Furthermore, this main effect was specific to subjective measures of social class. Multivariate analyses in Studies 1 and 2 revealed that (a) objective social class (i.e., parental education) did not significantly predict emotion recognition (though $p = .073$ in Study 2), and (b) subjective social class remained a significant predictor of emotion recognition after controlling for objective social class. The distinction between objective and subjective social class is significant because some previous research has suggested that the relation between social class and emotion recognition may be weaker than expected, or not present at all (e.g., Deveney et al., 2018). However, that research mainly focused on measuring objective social class (i.e., education, income). In the current research, objective and subjective social class were only moderately correlated. It follows, therefore, that individuals who possess the same absolute levels of material wealth and resources might still perceive their relative social class differently. Most importantly, these perceptions appear to play a role in regulating individual differences in emotion recognition skills.

Main Effect of Sex on Emotion Recognition

Consistent across Study 1 and Study 2, two different statistically significant sex differences emerged: (a) females did better than males on emotion recognition tasks, and (b) male performance was more variable than female performance on these tasks. Sex differences in skill levels (females higher) and variation (males higher) also emerged for incidental face memory (Study 3; see Supplementary Materials). Although female advantage on emotion recognition tasks has been extensively studied and discussed in past research (Hall, 1984; Kirkland et al., 2013; McClure, 2000; Thompson & Voyer, 2014), greater male variability is a relatively novel finding. To our knowledge, only one other study has reported findings related to male versus female variability in emotion recognition abilities specifically (Wright et al., 2018). As per the current results, Wright et al. (2018) also found greater male than female variability. Importantly, greater male variability in emotion recognition abilities is unlikely to be a spurious or artifactual result; it replicated across all analyses in all studies, and there is a larger empirical literature demonstrating higher male than female variability in other domains of cognitive functioning, such as intelligence (Deary et al., 2003; Gray et al., 2019; Hedges & Nowell, 1995; Johnson et al., 2008) and creativity (e.g., He & Wong, 2011; Ju et al., 2015; Karwowski et al., 2016), as well as in many aspects of brain structure across the lifespan (Wierenga et al., 2022).

Interaction Between Sex and Social Class

The most novel contribution to emerge from this work was the interaction between subjective social class and sex in predicting emotion recognition skills. We found that the original model proposed by Kraus and colleagues (2010, 2012)—linking social class with emotion recognition abilities (and empathic accuracy more generally)—applied to males but not to females. That is, only males who perceived themselves as higher in social class relative to others performed significantly worse at emotion recognition (and worse at spontaneously remembering faces). Convergent with this finding, at lower levels of subjective social class, there were no statistically significant differences in performance between males and females, but at higher levels of subjective social class, females performed significantly better than males. This interaction was consistent across all analyses in Studies 1 and 2. In total, the current findings in males concur with established theory and research linking higher perceived social class to being worse at paying attention to others and inferring their emotions; no special explanation is needed. By contrast, the lack of fit between the current findings in females and Kraus et al.'s (2010, 2012) contextualist model presents a significant puzzle.

As noted in the introduction, one potential explanation for the interaction between sex and social class is that the proposed explanatory mechanism specified by Kraus et al. (2010, 2012)—variation in the extent to which one's actions and outcomes are chronically influenced by external social factors outside of one's control—links both social class and sex with emotion recognition abilities. Kraus and colleagues (2010, 2012) stipulate that the capacity to pursue goals and achieve outcomes independent of external social influences (what we will refer to here as *empowerment*) leads higher social class individuals to be less attuned to contextual factors such as others' emotions and intentions. Indeed, Kraus et al. (2010, 2012) conceptualize empowerment as a perquisite of higher social class. Based on the current results, however, we hypothesize that the correlation between social class and empowerment is stronger in males than in females (Hypothesis 1). This hypothesis implies that, even when females are relatively high in social class, they still generally have less control over their life outcomes than do males and remain more dependent on others for achieving their goals. Consistent with the theorizing of Dietze and colleagues (2016, 2021), this may motivate females to chronically attend to the emotions/intentions of others—regardless of their perceived social class. This general lack of empowerment may be related to females having less social power than males (e.g., fewer formal positions of power, less social influence in groups; Carli, 1999; Colarelli et al., 2006; Eagly, 1983; Ragins & Sundstrom, 1989; Smith et al., 2021). In other words, the larger power structures that exist in society have frequently placed females in positions where they must depend on others to achieve their desired life outcomes. This relative lack of empowerment could potentially explain the observed interaction between sex and perceived social class in predicting emotion recognition abilities—and perhaps other theoretically relevant (contextualist) social-cognitive abilities (e.g., incidental face memory, the ability to adopt the visual perspective of others, empathic accuracy more broadly).

If empowerment is the mechanism linking both social class and sex to emotion recognition, this leads to a second testable hypothesis: controlling for social class, increased empowerment (as defined here) will be associated with decreased emotion recognition abilities in females (Hypothesis 2).[6] This hypothesis may also apply to other contextualist social-cognitive tendencies. If Hypothesis 1 and Hypothesis 2 are supported—indicating that social class and empowerment are only modestly correlated in females, and that empowerment predicts worse emotion recognition skills in females independent of social class—it would still largely converge with Kraus et al.'s (2010, 2012) contextualist model; however, it would require revising one of its assumptions: that social class can serve as a proxy for empowerment in females (as well as in males).

On the contrary, if it turns out that Hypothesis 1 and Hypothesis 2 are not supported, and neither social class nor empowerment predict emotion recognition skills and other theoretically relevant social-cognitive abilities in females, it would indicate the need for an alternative explanation. Such an explanation would need to account for not only the robustness of these abilities across different levels of social class and empowerment in females, but also females' higher skill levels and lower variability in performance. This overall patterning of results, if supported in future research, would converge with evolutionary models focusing on the centrality of emotion recognition skills in females as a result of their greater investment in and contribution to the survival of offspring throughout evolutionary history (Benenson et al., 2022; Hampson et al., 2006, 2021). These evolutionary models conceptualize emotion recognition abilities, and other related factors such as avoidance of confrontation, as adaptations that function to promote the survival of females and their children. Based on proposed linkages to survival and reproduction, evolutionary models posit higher skill levels in females, readily accommodate the finding that females display less variability in performance (i.e., their skill levels are more consistent), and do not predict diminution in emotion recognition skills as females gain greater social rank, empowerment, or access to resources.

As noted in the Introduction, research on the association between objective social class and emotion recognition abilities has produced inconsistent results that have been difficult to interpret. This raises the exploratory question (not part of our original analysis plan): Could these inconsistent results be explained by a moderating effect of sex? That is, do the effects of objective social class, like the effects of subjective social status, only apply to male participants? Consistent with mixed results obtained in past research, the main effects of objective social class on emotion recognition abilities were statistically nonsignificant in both Study 1 and Study 2. When testing for moderation by sex, however, we found significant sex by objective social class interactions in two of our three models. Just as with subjective measures, objective social class was inversely associated with emotion recognition skills in males but not females (see Supplemental Materials for further analysis and discussion of these findings). Even though the interaction effects were somewhat less consistent for objective than subjective social class, the moderating effect of sex may explain why past research on this topic has been conflicted. Although only subjective social class had main effects on emotion recognition abilities, both higher objective and subjective social class generally predicted worse emotion recognition skills in males. In total, males who have higher social status, whether measured objectively in terms of family educational achievement or subjectively in terms of self-perceptions, tended to be worse at emotion recognition.

Stimulus Generalization

A final contribution of this research was the use of the CAM to test the generalizability of the association between subjective social class and emotion recognition using more ecologically valid stimuli. Although the RMET is well validated as a measure of complex emotion recognition, it gives participants very limited visual information to work with. By contrast, the CAM presents participants with more wholistic expressions involving a moving picture of the full head and face. Interestingly, both the main effects of social class and the interaction between sex and social class replicated when using the CAM. In some past research (comparing maltreated and non-maltreated children), differences between people in emotion recognition skills were only obtained when using minimal stimuli (Pollak, 2008). By contrast, the current research indicates that lower subjective social class—at least in males—predicts better emotion recognition skills when using either more minimal or more maximal/wholistic stimuli. Given the goal of increasing ecological validity in psychological research, the successful use of the CAM to demonstrate a well-replicated effect is promising. These findings support the use of the CAM as a measure of complex emotion recognition abilities.

Limitations and Future Directions

Although this research has many notable strengths, we also highlight several limitations. First, although the CAM offers more complex and wholistic emotional stimuli than the RMET, it is still limited in its ecological validity. The task was presented as 4- to 6-s silent clips of facial emotional expressions on a computer screen. Real-life social interactions often include many other cues including vocal intonation, body language, and situational context. While there is a voice-only portion of the CAM, we did not include it in our study to limit the burden on participants. Future studies examining both main effects and interactions of social class and sex should aim to incorporate emotion recognition tasks that include more diverse stimuli that more accurately simulate real-life social interactions (e.g., interpersonal interaction tasks; see Kraus et al., 2010, 2011; Stellar et al., 2012).

In addition to stimulus generalizability, future work should test if the interaction between sex and social class applies to other theoretically relevant social cognition variables. Study 3 took a first step in this direction by conducting exploratory analyses of incidental face memory. Although the interaction between sex and social class was not statistically significant, it did trend in the expected direction, suggesting the potential value of testing the interaction effect more broadly in well-powered studies.

Another important direction for future research involves testing the empowerment hypotheses proposed here in the "Discussion" section. This will require developing valid and reliable measures of individual differences in empowerment, and/or experimentally manipulating empowerment, and incorporating these measures/manipulations into study designs. Researchers may also consider studying the intersection between social class and other sociocultural variables that may be connected to lower empowerment (e.g., race) as a way to further explore this mechanism.

We also want to acknowledge the limits to generalizability regarding our sample. Although we had substantial variability in subjective social class, all of the samples were predominantly White, English-speaking participants collected from an online platform in the United States. Thus, we expect that these effects will generalize to samples with similar characteristics, but recognize that further research (preferably with more diverse samples) is necessary before making any broad statements about sex and social class as they relate to emotion recognition ability.

Finally, we want to address the division of participants into two groups based on sex assigned at birth. We recognize that there are limitations to using sex instead of gender. For example, measuring sex is more likely to capture biological differences, whereas measuring gender is more likely to capture social and cultural differences. Classifying participants by sex can also be considered reductive and in some cases the sex binary can be considered harmful (Morgenroth & Ryan, 2021), and we want to clarify that we do not believe that people should be reduced to their sex at birth. Ultimately our decision to use sex came down to statistical and methodological simplicity. Even though neither gender nor sex are binary (e.g., Morgenroth & Ryan, 2021), sex could more justifiably be dichotomized (i.e., none of our participants chose "intersex" when asked about their sex assigned at birth). We also did not want nonbinary people to be excluded from our sample. Along these lines, we have been careful not to conflate the terms "men" and "women" with "males" and "females" in describing our sample and have tried to make explicit that we are talking about sex differences, not gender differences, in our analyses (though we do believe that these differences could apply to gender given the majority of our sample had gender identities that matched with their sex assigned at birth). Future studies would benefit from collecting samples that are more gender and culturally diverse to more clearly parse out the effects of both sex and gender.

Conclusion

This research provides further support for the relation between subjective social class and emotion recognition and refines the literature by suggesting that this effect may only apply to a subset of the population (i.e., males). Our findings demonstrate that membership in different social groups/categories may not operate independently in predicting emotion recognition skills, and perhaps social cognition more broadly. Future research should focus on more clearly measuring and identifying potential mechanisms that explain the moderating effect of sex. More generally, it is important for researchers to thoughtfully and intentionally examine the nuances that result from studying intersecting identities in psychological research.

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ORCID iD

Susan A Brener https://orcid.org/0000-0001-6077-2633

Supplemental Material

Supplemental material is available online with this article.

Notes

1. In a set of small, non-preregistered, experimental studies, where emotion recognition skills were assessed on the basis of real-life interactions between participants (e.g., a mock job interview, teasing interactions with a friend), both subjective and objective measures of higher social class predicted lower skill levels and less empathic responding (Kraus et al., 2010, 2011; Stellar et al., 2012). We choose not to overinterpret these findings, as the studies were not preregistered and replication studies have not been conducted.
2. It is important to note that, although measures such as income, education, and occupation are all considered indicators of objective SES in the psychology literature, these measures are not interchangeable and can yield contradictory results when used in research (Antonoplis, 2022).
3. As mentioned in the text, Study 1 was part of a larger study that also examined the effects of various early childhood experiences on emotion recognition; thus, a large portion of the preregistration is dedicated to that topic. The analyses focusing on childhood experiences are not reported here. All study measures (including those that are not reported) are included in the materials file linked in the main text.
4. We asked participants for parental education rather than self-education or income because a large portion of the sample was college-aged and many participants indicated that they were students, thus we did not think that participants' current education or income had adequate variance for our question of interest.

5. We recognize that both sex and gender may contribute to differences in emotion recognition abilities, and that using sex rather than gender has certain limitations. We discuss these limitations as well as our reasoning for using sex in the "Discussion" section.
6. Hypothesis 2 may not apply to males. Because perceived social class and empowerment are hypothesized to be comparable in males (i.e., highly correlated, as per Hypothesis 1), it would not make sense to control for one while testing for the effects of the other. Rather, consistent with Kraus et al. (2010, 2012), empowerment may mediate the effects of social class on emotion recognition abilities in males.

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