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External motivation to avoid prejudice alters neural responses to targets varying in race and status

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Abstract

Those who are high in external motivation to respond without prejudice (EMS) tend to focus on non-racial attributes when describing others. This fMRI study examined the neural processing of race and an alternative yet stereotypically relevant attribute (viz., socioeconomic status: SES) as a function of the perceiver's EMS. Sixty-one White participants privately formed impressions of Black and White faces ascribed with high or low SES. Analyses focused on regions supporting race- and status-based reward/salience (NAcc), evaluation (VMPFC) and threat/relevance (amygdala). Consistent with previous findings from the literature on status-based evaluation, we observed greater neural responses to high-status (*vs* low-status) targets in all regions of interest when participants were relatively low in EMS. In contrast, we observed the opposite pattern when participants were relatively high in EMS. Notably, all effects were independent of target race. In summary, White perceivers' race-related motivations similarly altered their neural responses to the SES of Black and White targets. Specifically, the findings suggest that EMS may attenuate the positive value and/or salience of high status in a mixed-race context. Findings are discussed in the context of the stereotypic relationship between race and SES.

Key words: socioeconomic status; race; person evaluation; external motivation to respond without prejudice

Introduction

Race remains a topic that generates considerable tension in the USA. For racial majority members (i.e. Whites), cross-race perception and interaction can elicit threat or anxiety due to concerns about violating egalitarian norms (Plant and Devine, 1998, 2003; Richeson and Shelton, 2003; Richeson and Trawalter, 2008; Amodio, 2009), even when such norms are explicitly endorsed (Ickes, 1984; Gaertner and Dovidio, 1986; Devine *et al.*, 1996). In contrast to individuals who intentionally cultivate an egalitarian self-concept (i.e. internal motivation to respond without prejudice, IMS: Amodio *et al.*, 2003, 2008), individuals who are motivated to avoid the social sanctions of expressing prejudice (i.e. external motivation to respond without prejudice, EMS: Butz and Plant, 2009; Olson and Zabel, 2015) can be especially uncomfortable when race is salient (Amodio *et al.*, 2006). Potentially due to race-related discomfort, high-EMS Whites typically engage in more effortful (albeit less efficient) self-regulation during intergroup interactions (Lambert *et al.*, 2003; Richeson *et al.*, 2003; Richeson and Shelton, 2003; Hausmann and Ryan, 2004; Wyer, 2007; Ito *et al.*, 2015). High-EMS individuals also tend to avoid explicit mentions of race, focusing instead on non-racial categories or topics (Norton *et al.*, 2006; Apfelbaum *et al.*, 2008). This study examines the neural responses to perceived race and non-racial attributes

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(viz., socioeconomic status: SES) as a function of White perceivers' EMS levels.

In this study, we aimed to address two key gaps in the literature on race and status. Although previous work has found that high-EMS Whites favor the use of perceived non-racial attributes (e.g. age and gender) over race when describing people (Apfelbaum *et al.*, 2008), it is unclear whether and how high-EMS individuals use relatively more knowledge-based attributes (e.g. SES), to inform interracial impressions. SES is particularly relevant in the context of race due to evidence of race–SES associations (Allport, 1954; Weeks and Lupfer, 2004; Penner and Saperstein, 2008; Freeman *et al.*, 2011; Sanchez and Garcia, 2012; Brannon and Markus, 2013). Despite this evidence, few studies have explored how race and status jointly affect person evaluation (Smedley and Bayton, 1978; Fiske *et al.*, 2016; Richeson and Sommers, 2016). Additionally, few fMRI studies have considered effects of motivation on evaluative bias (but see Wheeler and Fiske, 2005; Li *et al.*, 2016), and none have examined the role of EMS to our knowledge. This is surprising given the extensive behavioral and electrophysiological literature on this important motivation (Blascovich *et al.*, 2001; Mendes *et al.*, 2002; Plant and Devine, 2003; Paolini *et al.*, 2004; Amodio *et al.*, 2006; Mendes *et al.*, 2007; Page-Gould *et al.*, 2008, 2010; Amodio, 2009; Bijleveld *et al.*, 2012; Trawalter *et al.*, 2012). Addressing these gaps in the literature, we examine how EMS shapes neural responses during evaluations of targets varying in race and SES in key regions believed to support reward/salience (ventral striatum: VS), person evaluation (VMPFC) and threat/relevance (amygdala).

The VS and its cortical afferents (e.g. OFC, VMPFC and amygdala) are responsive to various aspects of reward (Berridge and Kringelbach, 2008; Ruff and Fehr, 2014), including the evaluation of rewarding perceptual (Cloutier *et al.*, 2008) and knowledge-based (Delgado *et al.*, 2005) cues. The VS is also sensitive to personal and emotional salience more broadly (Phan *et al.*, 2004; Cooper and Knutson, 2008), showing attenuated responses during the regulation of negative affect (Phan *et al.*, 2005). Consistent with the VS's sensitivity to reward and salience, VS activity is modulated by both social status and race (Zink *et al.*, 2008; Ly *et al.*, 2011; Stanley *et al.*, 2012; Ligneul and Dreher, 2017). For example, Stanley *et al.* (2012) found that participants who trusted Blacks less than Whites showed greater VS activity (viz., NAcc) to trusted Blacks, perhaps reflecting the salience of reward-related outcomes (positive or negative) in uncertain contexts (Cooper and Knutson, 2008; Knutson *et al.*, 2008). Increased VS activity has also been found to high (*vs* low) status in competence-based hierarchies (Zink *et al.*, 2008), corroborating work from the animal literature on the intrinsic reward value (Deaner *et al.*, 2005) and salience (Shepherd *et al.*, 2006) of high status. Taken together, these findings indicate that the VS responds to the reward value or socioemotional salience of others, with greater responses to more rewarding/salient targets.

The VMPFC is believed to support the elaboration of affective meaning (Roy *et al.*, 2012; Delgado *et al.*, 2016). During person evaluation, the VMPFC is responsive the perceiver's degree of background knowledge and/or experience with the target (Gilbert *et al.*, 2012; Flagan and Beer, 2013) and has been posited to index positive evaluations based on social status (Cloutier *et al.*, 2012, 2016; Cloutier and Gyurovski, 2014). On this account, the VMPFC should respond similarly to the VS, showing greater responses to targets paired with positive knowledge-based attributes (viz., high status). Given little evidence of race effects in the VMPFC, it is unclear if this region is also involved in race-based evaluations.

The amygdala responds to arousing and biologically relevant stimuli (Phelps and LeDoux, 2005; Adolphs, 2010) and is sensitive to perceived race (Kubota *et al.*, 2012). Like for the VS, amygdala activity is attenuated during the regulation of negative affect (Phan *et al.*, 2005). In the absence of additional information, White perceivers show greater and more sustained amygdala activity for Black than White targets (Hart *et al.*, 2000; Phelps *et al.*, 2000; Ronquillo *et al.*, 2007), especially for perceivers with greater implicit anti-Black associations (Phelps *et al.*, 2000; Cunningham *et al.*, 2004; Brosch *et al.*, 2013). However, when White perceivers are given sufficient time (Cunningham *et al.*, 2004) or instructions to form impressions of Black targets (Wheeler and Fiske, 2005), amygdala sensitivity to race has not been observed (Chekroud *et al.*, 2014). Additionally, race-related amygdala activity is diminished when faces display an averted (*vs* direct) gaze, presumably posing less relevance or threat to the perceiver (Richeson *et al.*, 2008). Although the amygdala has received considerably less attention in the fMRI literature on status, findings suggest that the amygdala is sensitive to high-status targets, unstable hierarchies and status-based learning and memory (Mattan *et al.*, 2017).

In this study, we examined regions of interest (ROIs) implicated in reward/salience (NAcc in the VS), social evaluation (VMPFC) and threat/relevance (amygdala) as White perceivers formed impressions of faces varying in race and SES. In particular, we assessed whether these regions were responsive to individual differences in EMS.

Based on the literature reviewed earlier, one possibility is that race and SES have independent effects on person evaluation. Because high-EMS White perceivers find perceiving Black targets potentially aversive, Black targets should diminish activity in NAcc (i.e. reward/salience) and VMPFC (i.e. social evaluation) and potentially increase amygdala (i.e. threat/relevance) responses. We also expected that high (*vs* low) SES would elicit greater activity in the NAcc and VMPFC (Mattan *et al.*, 2017). However, it was unclear how EMS would affect perceived SES. Some research suggests that high-EMS Whites may be motivated to favor non-racial attributes or topics over race (Norton *et al.*, 2006; Apfelbaum *et al.*, 2008). Accordingly, an EMS-related preference for non-racial attributes may enhance the evaluative significance of high SES. Alternatively, other work suggests that EMS biases visual attention toward rather than away from race (Richeson and Trawalter, 2008; Bean *et al.*, 2012). From this perspective, the salience of other social dimensions (e.g. SES) may diminish, thereby attenuating the usual pattern of status-based neural evaluation (i.e. high $>$ low: Mattan *et al.*, 2017).

Another possibility consistent with previously observed categorical associations between race and status (Weeks and Lupfer, 2004; Penner and Saperstein, 2008; Freeman *et al.*, 2011; Lei and Bodenhausen, 2017) is that race and status may interact during person evaluation (Correll *et al.*, 2011; Moore-Berg *et al.*, 2017). Due to high-EMS perceivers' anxiety about appearing prejudiced (Amodio *et al.*, 2006) and tendency to focus on non-racial attributes (Norton *et al.*, 2006; Apfelbaum *et al.*, 2008), NAcc and VMPFC responses may evince a simultaneously enhanced evaluation of high-SES Black targets and a devaluation of high-SES White targets (Bergsieker *et al.*, 2010; Swencionis and Fiske, 2016)—with the reverse pattern in amygdala activation. In other words, the race by SES interaction should result in a larger effect of SES for Black (*vs* White) targets in the entire network of brain regions supporting person evaluation.

Materials and methods

Participants

Chicago-area men were recruited via online ads, fliers and banners on public transportation; 82 participants passed initial screening (Supplementary Material S1). Of the 82 eligible participants, 61 completed the study. One participant was excluded from analyses as an outlier for IMS (a control variable), exceeding 3.5 s.d. from the sample means (see Results). The final sample comprised 60 male participants ($M_{age} = 23.8$ years, $s.d._{age} = 4.59$ years). Participants provided informed consent in accordance with the Declaration of Helsinki and approved by the University of Chicago IRB.

Protocol

Key measures and procedures are reported later. However, a complete account of measures and procedures is provided in Supplementary Materials S1 and S2.

Online pretesting session. Eligible participants completed a battery of questionnaires online. Most of these measures were assessed for a large-scale resting-state fMRI investigation or an unrelated experiment completed immediately prior to the impression-formation task.

fMRI session. Upon pretest completion, participants were scheduled; on the day of scanning, participants were instructed to arrive without having consumed drugs including caffeine and alcohol.

Pre-scan. After signing consent and imaging center paperwork, the participant was photographed and completed surveys. Before entering the scanner, participants were trained on the impression-formation task.

Scanning. Participants first completed two fMRI runs of an unrelated task. After this task, participants completed a brief reminder task of the status–color associations and button box responding. All participants correctly recalled the status–color associations. After this reminder, participants completed two runs of the impression-formation task (each ∼4 min), followed by resting-state and anatomical scans, time permitting (total scan time ∼1 h).

Post-scan. Participants completed explicit stimulus ratings and judgments. After this block of surveys, participants were compensated and debriefed.

Status–color association training. Participants learned that this study was interested in how people think of others varying in SES. SES was defined as follows: 'those who have the highest social status tend to have the most money, the most education and the most respected jobs. Those who have the lowest social status tend to have the least money, the least education and the least respected jobs or no job'. Following this definition, participants learned to associate colors with low- and high-status Americans (e.g. blue = low and orange = high). Status–color associations were counterbalanced across participants.

To thoroughly learn status–color associations, participants completed simple association training blocks (Mitchell *et al.*, 2004, 2005; Cloutier *et al.*, 2013; Cloutier and Gyurovski, 2014). In an initial block of 10 trials, participants viewed a darkened silhouette over a colored background (i.e. orange or blue: five per status level), indicating by key press whether the silhouette was low or high status based on the background color. Participants were informed of their cumulative accuracy on each trial (M = 98.5%). Next, participants completed a block of 10 trials (five per status level) in which they were asked what color represents low (or high) status. Participants were again informed of their cumulative accuracy on each trial (M = 93.4%).

Measures

Impression-formation task. Having learned the two status–color associations, participants briefly practiced the impression-formation task before scanning. The experimenter first verbally confirmed that the participant learned the status-color associations and then explained that participants would no longer be categorizing targets as low or high in status for the impression-formation task. Instead, they would be forming quick overall impressions of male faces, taking into account all visually available information (Cloutier and Gyurovski, 2014). This was repeated for participants in the written instructions for the practice block of the impression-formation task.

The procedures for the practice and functional scanning blocks were identical and adhered to a rapid event-related design (Friston *et al.*, 1999). Trials began with a male face surrounded by a colored frame over a black background. After 1500 ms, the face was replaced by a white fixation of a jittered duration (i.e. intertrial interval of 500, 2500, 4500 or 6500 ms). Participants formed a quick impression of each individual by the time the face disappeared or shortly thereafter. To signal they formed an impression, participants simultaneously pressed two keys, one per index finger. Participants were informed that their responses were not meant to indicate of the content of their impressions but merely to indicate that they had formed an impression. In each run of the impression-formation task, participants viewed 60 male faces divided evenly across conditions (see Supplementary Material S3 for details on stimulus equating). Two reminder trials after the first and second thirds of the sequence required participants to identify the status level of a silhouette framed by either blue or orange.

Faces from all four conditions were interspersed in a fixed pseudorandom sequence. To optimize fMRI design efficiency (Dale, 1999), three fixed trial sequences were generated using optseq2 (Greve, 2002: see Supplementary Material S3). After counterbalancing first color order (i.e. blue *vs* orange) and status–color associations, four versions of the impression-formation task were generated for each trial sequence. Over the course of the experiment, participants completed one corresponding counterbalanced version from each trial sequence (i.e. the practice block and two experimental runs).

Motivation to respond without prejudice. This 10-item measure administered online during the pretest block assesses external (EMS—5 items) and internal (IMS—5 items) motivations to avoid prejudice toward Black Americans (Plant and Devine, 1998) on a 9-point scale from 1 = strongly disagree to 9 = strongly agree. EMS and IMS were uncorrelated in the final sample, $r(59) = 0.052$, $P = 0.694$. For details on the distributions of EMS and IMS, see Supplementary Material S4.

fMRI acquisition and GLM

We used a Phillips dStream Achieva 3T system and 32-channel head coil to acquire BOLD, T2* contrast-weighted EPIs. With a 2000 ms repetition time and a 25 ms echo time, we acquired 34 oblique slices using an interleaved z-shim acquisition protocol (Du *et al.*, 2007). Slices were 4 mm thick with a 0.5 mm gap, a 3 mm^2 in-plane resolution, 77° flip angle and a 192 × 134 × 192 mm field of view. Slices were aligned to the AC–PC axis of each participant (Deichmann *et al.*, 2003).

EPIs from each participant's two runs were preprocessed and analyzed using SPM8 (www.fil.ion.ucl.ac.uk/spm), facilitated by a custom suite of scripts for fMRI analysis (https://github.com/ddwagner/SPM8w). We first implemented slice-time correction (Sladky *et al.*, 2011), using the 17th slice acquisition as the reference. Subsequently, we integrated the four repeated z-shim slices (Du *et al.*, 2007). The resulting images from each participant were then unwarped and realigned to the participant's mean EPI to correct for motion and motion-by-distortion interactions (Andersson *et al.*, 2001). Images were subsequently normalized to the MNI template and smoothed with an 8 mm FWHM kernel (Ashburner and Friston, 1999).

To estimate the BOLD responses for each condition, each trial was considered as an event, and the stimulus time series was convolved with the canonical hemodynamic response function (HRF). (During the review process, parallel analyses were conducted modeling the temporal and dispersion derivatives in addition to the canonical HRF. Results—available upon request—were similar to the model reported here.) A GLM modeled both scan sequences concatenated as a single session with regressors for each of the four conditions (ordered as follows: high-status Black, high-status White, low-status Black and low-status White) followed by regressors controlling for variance associated with: (i) reminder trials; (ii) low-frequency drift (i.e. a linear trend); (iii) session means (1 for scan 1, 0 for scan 2); (iv) six movement parameters; (v) a constant across all scans and (vi) slow fluctuation of the signal (i.e. a standard set of harmonic regressors effectively serving as a 1/128-Hz high-pass filter). Contrast images reflecting the first-level effects of interest were used in second-level analyses.

Analysis

Primary analyses focused on correlations between EMS and task-related activity in key ROIs. Additionally, we conducted exploratory whole-brain regression analyses, testing for activity that correlated with EMS. In all analyses, we controlled for IMS by modeling it as an independent covariate of non-interest. Because mean IMS was 7.64 (on a scale from 1 to 9), all models assume a high-IMS participant sample. For all analyses, the pattern of findings was similar with or without the IMS covariate. Full results from the whole-brain analyses as well as group-level contrasts for effects of race, status and the Race × Status interaction are reported in Supplementary Material S4.

ROI analyses. Guided by previous neuroimaging work on status-based person evaluation, we extracted BOLD activity from ROIs in the VMPFC, $\text{MNI}_{x,\ y,\ z} = [0, 52, -6]$ (Cloutier *et al.*, 2012), left NAcc, $\text{MNI}_{x,\ y,\ z} = [-9, 8, -8]$ and right NAcc, $\text{MNI}_{x,\ y,\ z} = [9, 14, -6]$ (Cloutier *et al.*, 2008) and left amygdala, $\text{MNI}_{x,\ y,\ z} = [-24, -3, -12]$ and right amygdala, $\text{MNI}_{x,\ y,\ z} = [24, -3, -21]$ (Cloutier *et al.*, 2014). Average parameter estimates (*vs* baseline) were extracted for each condition from an 8 mm sphere (VMPFC) or a 4 mm sphere (NAcc, amygdalae).

ROIs were analyzed using the lme4 package for linear mixed-effects models (Bates *et al.*, 2015) in R (R Core Team, 2017). Degrees of freedom were estimated using Satterthwaite's approximation, provided by the package lmerTest, version 2.0–33 (Kuznetsova *et al.*, 2016). Face stimulus coding for all models was as follows: Blacks = −0.5, Whites = 0.5, low status = −0.5 and high status = 0.5. EMS was treated as a continuous predictor. Random intercepts were modeled to account for participant-level variations in average neural response. For each ROI, we examined whether race, status, EMS and all possible interactions predicted neural activity.

Exploratory whole-brain regressions. We conducted three separate second-level GLMs for (i) the main effect of race, (ii) the main effect of status and (iii) the Race × Status interaction (see Supplementary Material S4). Similar to the ROI analyses, second-level GLMs examined correlations between each effect and EMS. For all whole-brain analyses, we used a voxel-level threshold of $P < 0.001$ with a cluster extent threshold of 53 voxels as determined by AlphaSim. It should be noted that cluster-level thresholds generated by AlphaSim do not adequately control for false positives in all conditions, especially for parametric analyses (Eklund *et al.*, 2016). Therefore, these exploratory analyses should be interpreted with caution, pending future replication.

Results

ROI analyses

NAcc. Because results from the left and right NAcc largely converged, we report them together. As predicted, results revealed a significant main effect of status, with a greater neural response to high-status compared with low-status faces in left, $b = 0.352$, $\text{SE} = 0.121$, $\text{CI}_{95\%} = [0.115, 0.590]$, $t(174) = 2.910$, $P = 0.004$, and right NAcc, $b = 0.457$, $\text{SE} = 0.165$, $\text{CI}_{95\%} = [0.134, 0.780]$, $t(174) = 2.775$, $P = 0.006$. Critically, this status effect was significantly modulated by EMS in the left, $b = -0.0668$, $\text{SE} = 0.0221$, $\text{CI}_{95\%} = [-0.110, -0.0235]$, $t(174) = -3.021$, $P = 0.003$, and right NAcc, $b = -0.0604$, $\text{SE} = 0.0301$, $\text{CI}_{95\%} = [-0.146, -0.0284]$, $t(174) = -2.903$, $P = 0.004$. All other effects were non-significant, $P > 0.11$ and > 0.16 for the left and right NAcc, respectively.

To decompose the Status × EMS interaction, a series of follow-up models tested for: (i) the simple slopes of EMS for each status level and (ii) the simple effects of status for participants at varying levels of EMS. Collapsing across race, these models predicted left and right NAcc response as a function of status, EMS and Status × EMS. Separately for low status (low = 1, high = 0) and high status (low = 0, high = 1), we evaluated the earlier model at low (−1.5 s.d.), mean and high (+1.5 s.d.) EMS (Figure 1). Statistics for the left and right NAcc are reported in Tables 1 and 2, respectively.

Summary. Consistent with previous findings (Zink *et al.*, 2008), we observed greater NAcc responses to high-status (*vs* low-status) targets but only at low-EMS levels. At high levels of EMS, we observed the opposite—NAcc responses were greater to low-status (*vs* high-status) targets. NAcc responses did not show any effects of race.

VMPFC. Results revealed a significant main effect of status, with greater neural response to high status than low status, $b = 0.947$, $\text{SE} = 0.358$, $\text{CI}_{95\%} = [0.245, 1.649]$, $t(174) = 2.646$, $P = 0.009$. This status effect was significantly modulated by EMS, $b = -0.187$, $\text{SE} = 0.0654$, $\text{CI}_{95\%} = [-0.315, -0.0584]$, $t(174) = -2.853$, $P = 0.005$. All other effects were non-significant, $P > 0.15$.

To decompose the Status × EMS interaction, a series of follow-up models tested for: (i) the simple slopes of EMS for each level of status and (ii) the simple effects of status for participants at varying levels of EMS. Collapsing across race, these models predicted VMPFC response as a function of status, EMS and Status × EMS.

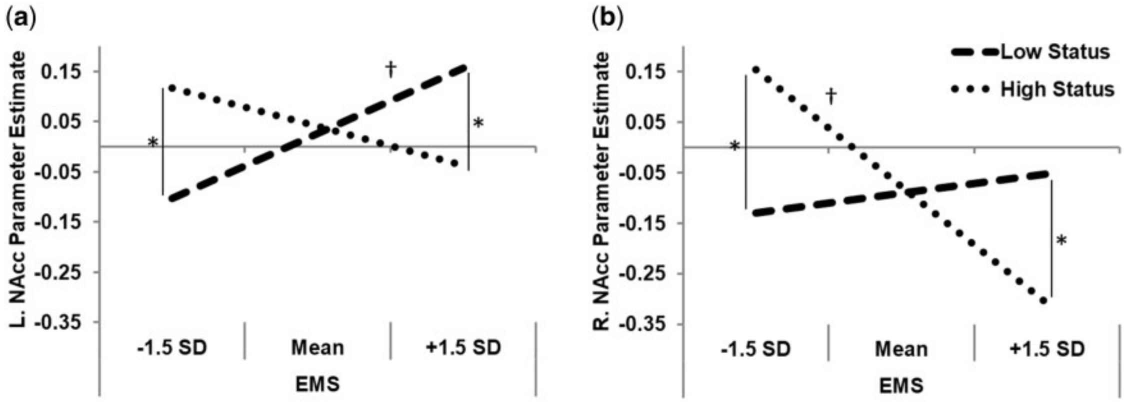

Fig. 1. Left (a) and right (b) NAcc response as a function of status level at low (−1.5 s.d.), mean and high (+1.5 s.d.) EMS. Significant slopes (†) and significant simple effects (*) are indicated, $P < 0.05$.

Table 1. Contrast statistics for Status × EMS interaction in the left NAcc

Analyses	Group	*b*	SE	$CI_{95\%}$	*t*	df	*P*
High–low EMS	Low status	0.042	0.020	[0.003, 0.081]	2.129	114	**0.035***
	High status	−0.025	0.020	[−0.063, 0.014]	−1.260	114	0.209
High–low status	Low EMS	0.220	0.082	[0.059, 0.381]	2.675	178	**0.008***
	Mean EMS	0.013	0.045	[−0.074, 0.106]	0.290	178	0.772
	High EMS	−0.194	0.082	[−0.355, −0.033]	−2.360	178	**0.020***

Note: Significant statistics are indicated by bolded *P* values and an asterisk (*).

Table 2. Contrast statistics for Status × EMS interaction in the right NAcc

Analyses	Group	*b*	SE	$CI_{95\%}$	*t*	df	*P*
High–low EMS	Low status	0.013	0.027	[−0.040, 0.065]	0.466	113	0.642
	High status	−0.075	0.027	[−0.128, −0.022]	−2.780	113	**0.006***
High–low status	Low EMS	0.284	0.112	[0.065, 0.503]	2.538	178	**0.012***
	Mean EMS	0.014	0.062	[−0.107, 0.134]	0.219	178	0.827
	High EMS	−0.257	0.112	[−0.476, −0.038]	−2.300	178	**0.023***

Note: Significant statistics are indicated by bolded *P* values and an asterisk (*).

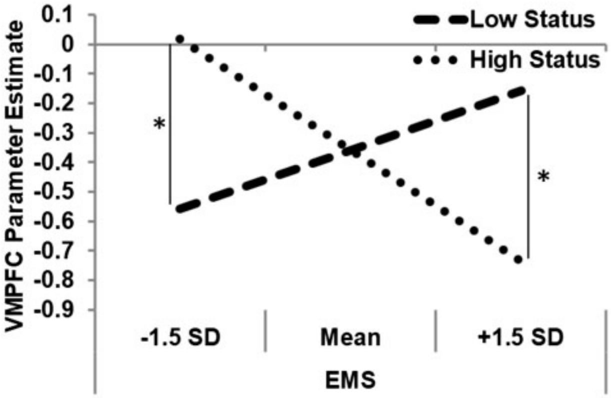

Fig. 2. VMPFC response as a function of target status at low (−1.5 s.d.), mean and high (+1.5 s.d.) EMS. Significant simple effects (*) are indicated, $P < 0.05$.

Separately for low status (low = 1, high = 0) and high status (low = 0, high = 1), we evaluated the earlier model at low (−1.5 s.d.), mean and high (+1.5 s.d.) EMS (Figure 2). Simple slopes and effects statistics are reported in Table 3.

Summary. Overall, results in the VMPFC mirrored findings in the bilateral NAcc. Consistent with our review of status-based evaluation (Mattan *et al.*, 2017), we observed greater VMPFC responses to high-status (*vs* low-status) targets but only at low-EMS levels. At high levels of EMS, we observed the opposite—VMPFC responses were greater to low-status (*vs* high-status) targets. VMPFC responses did not show any effects of race.

Amygdalae. In the amygdala, all significant effects were right-lateralized. Specifically, we found a significant main effect of status, with a greater neural response to high status than low status, $b = 0.408$, $SE = 0.197$, $CI_{95\%} = [0.022, 0.794]$, $t(174) = 2.073$, $P = 0.040$. This status effect was significantly modulated by EMS, $b = -0.086$, $SE = 0.0360$, $CI_{95\%} = [-0.156, -0.0152]$, $t(174) = -2.381$, $P = 0.018$. All other effects in the bilateral amygdala were non-significant, $P > 0.12$.

To decompose the Status × EMS interaction, a series of follow-up models tested for: (i) the simple slopes of EMS for each level of status and (ii) the simple effects of status for participants at varying levels of EMS. Collapsing across race, these models predicted right amygdala response as a function of status, EMS and Status × EMS. Separately for low status (low = 1,

Table 3. Contrast statistics for Status × EMS interaction in the VMPFC

Analyses	Group	*b*	SE	$CI_{95\%}$	t	df	*P*
High–low EMS	High status	−0.122	0.078	[−0.275, 0.031]	−1.56	82	0.123
	Low status	0.064	0.078	[−0.088, 0.218]	0.829	82	0.410
High–low status	Low EMS	0.577	0.241	[0.106, 1.049]	2.399	178	**0.017***
	Mean EMS	−0.000	0.133	[−0.260, 0.260]	0.000	178	0.999
	High EMS	−0.578	0.241	[−1.049, −0.106]	−2.400	178	**0.017***

Note: Significant statistics are indicated by bolded *P* values and an asterisk (*).

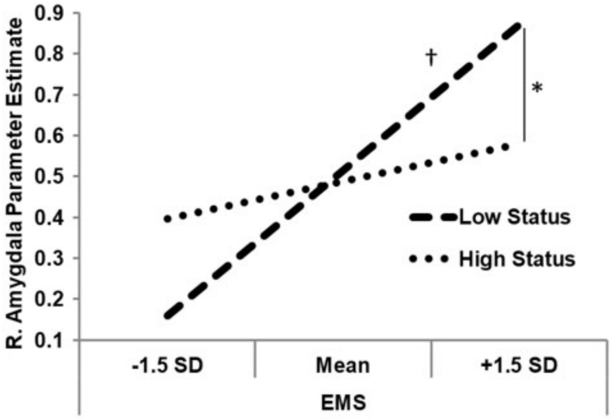

Fig. 3. Right amygdala response as a function of target status at low (−1.5 s.d.), mean and high (+1.5 s.d.) EMS. Significant slopes (†) and significant simple effects (*) are indicated, $P < 0.05$.

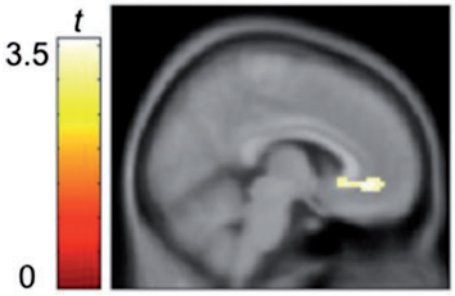

Fig. 4. Whole-brain regressions targeting status revealed a 56-voxel cluster in the VMPFC ($MNI_{x,\ y,\ z} = [6, 39, -6]$) that corroborated the Status × EMS interaction found in the VMPFC ROI analysis (voxel-wise threshold, $P < 0.001$, extent threshold of $k = 53$ voxels as determined by AlphaSim).

high = 0) and high status (low = 0, high = 1), we evaluated the earlier model at low (−1.5 s.d.), mean and high (+1.5 s.d.) EMS (Figure 3). Simple slopes and effects statistics are reported in Table 4.

Summary. Overall, activity in the right amygdala was similar to the observed patterns in the NAcc and VMPFC. At low-EMS levels, we observed similar amygdala responses to high- and low-status targets. At high levels of EMS, amygdala responses were greater to low-status (*vs* high-status) targets. Consistent with research failing to observe race differences in amygdala responses when person knowledge is present (Chekroud *et al.*, 2014), the amygdalae did not show any reliable effects of race.

Exploratory whole-brain regressions

Results revealed a number of significant clusters correlating with the main effect of status but none for any effects implicating race. We observed some convergent evidence for status effects in the VMPFC/OFC (56 voxels: Figure 4). At a more liberal voxel-wise threshold of $P < 0.005$ ($k > 117$ voxels), this significant cluster increased to 469 voxels, extending into the bilateral NAcc. Full details of exploratory whole-brain regressions are reported in Supplementary Material S4.

Discussion

The present research found that EMS modulated the processing of a non-racial attribute (viz., status) in a network of brain regions involved in person evaluation. Consistent with previous findings, we observed greater responses to high-status (*vs* low-status) targets in the bilateral NAcc and VMPFC but only at low-EMS levels. The opposite pattern (low > high) was observed at high levels of EMS in the bilateral NAcc, VMPFC and right amygdala. Notably, these effects of status were independent of target race, consistent with previous findings suggesting that perceived race and status can, in some instances, contribute independently to person evaluations (Smedley and Bayton, 1978; Blascovich *et al.*, 2001; Mattan *et al.*, under review).

Status effects

Results were consistent with previous work on the neural evaluation of social status (Mattan *et al.*, 2017). Findings from the behavioral literature have shown that high-status targets are generally evaluated more positively (Fiske, 2010; Varnum, 2013). Consistent with this picture, high-status (*vs* low-status) targets elicited greater activity in regions that have previously been implicated in processing reward/salience (NAcc: Berridge and Kringelbach, 2008; Ruff and Fehr, 2014), affective meaning (VMPFC: Roy *et al.*, 2012; Delgado *et al.*, 2016) and personal or biological relevance (amygdalae: Phelps and LeDoux, 2005; Adolphs, 2010). Moreover, all three regions have previously been implicated in positive evaluations of high-status individuals (Singer *et al.*, 2004; Zink *et al.*, 2008; Freeman *et al.*, 2009; Cloutier *et al.*, 2012; Cloutier and Gyurovski, 2014). Notably, this expected pattern of status-based evaluation was only present at low-EMS levels. At high-EMS levels, neural responses to status were reversed, with stronger activity for low-status compared with high-status targets. This finding implies that high-EMS levels may diminish the potential value or salience of high status during person evaluation. The finding may also suggest an aversion toward high-status individuals among high-EMS participants. The underlying mechanism of this EMS-related shift on status requires further study. Nonetheless, in the absence of any observed relationships between race and EMS, this pattern of findings is not easily explained by an EMS-related heightening of race salience (Richeson and Trawalter, 2008; Bean *et al.*,

Table 4. Contrast statistics for Status × EMS interaction in the right amygdala

Analyses	Group	*b*	SE	$CI_{95\%}$	*t*	df	*P*
High–low EMS	High status	0.030	0.050	[−0.068, 0.128]	0.593	75	0.555
	Low status	0.115	0.050	[0.017, 0.213]	2.307	75	**0.024***
High–low status	Low EMS	0.238	0.133	[−0.022, 0.499]	1.793	178	0.075
	Mean EMS	−0.027	0.073	[−0.170, 0.117]	−0.360	178	0.716
	High EMS	−0.292	0.133	[−0.552, −0.031]	−2.200	178	**0.029***

Note: Significant statistics are indicated by bolded *P* values and an asterisk (*).

2012) at the expense of non-racial attributes such as status. More consistent with the literature and overall set of findings is the possibility that high-EMS individuals were indeed shifting their focus to non-racial attributes (viz., status) as they formed impressions of targets (Norton *et al.*, 2006; Apfelbaum *et al.*, 2008). However, this shift should not be characterized as an accentuation of the usual high-status–positive association (Varnum, 2013). One possibility is that the externally motivated shift to status-based evaluation to avoid race may have diminished the ordinarily high-motivational value assigned to high status (cf. Deci *et al.*, 1999). Another possibility is that race-related EMS may generalize to other domains such as status. This potentially interesting question of domain generalization awaits further research.

Race effects

Although an extensive network of brain regions has been implicated in processing race (Kubota *et al.*, 2012), this study did not observe differences as a function of perceived race. Perhaps more surprisingly, perceiver EMS did not reliably modulate the perception of race. We speculate that the presence of status may explain the absence of sensitivity to race (cf. Kurzban *et al.*, 2001). Alternatively, the emphasis placed on status during the initial status training procedure with silhouettes may have encouraged participants to focus on status even after the introduction of real faces varying in race. We note that the neural representation of race is frequently sensitive to context. Early work on the neural correlates of race paid considerable attention to the role of the amygdala (Phelps *et al.*, 2000); however, subsequent work has found that race-based activity in this region is sensitive to a number of factors. For example, when White perceivers are given sufficient time (Cunningham *et al.*, 2004), specific instructions to form impressions of Black targets (Wheeler and Fiske, 2005; Li *et al.*, 2016) or additional attributes (Van Bavel *et al.*, 2008; Li *et al.*, 2016), race-based amygdala activity tends not to be observed (Chekroud *et al.*, 2014).

In this study, meaningful effects of EMS were observed in a relatively high-IMS sample. Notably, distinct behavioral profiles are associated with a perceiver's combination of EMS and IMS (Butz and Plant, 2009). High-IMS individuals who are low in EMS are generally effective at regulating prejudice (Devine *et al.*, 2002; Li *et al.*, 2016). Individuals high in IMS and EMS are determined to control their prejudice. However, their preoccupation with appearing prejudiced makes them less effective in this endeavor (Amodio *et al.*, 2008), perhaps especially when effortful control is difficult (e.g. under acute stress). Future work sampling a wider range of IMS is needed to better understand the role of EMS on neural evaluation in low-IMS perceivers.

Finally, although this study assessed cortisol levels in participants (Supplementary Material S2), the limited range of cortisol reactivity that was obtained precluded the opportunity to clearly investigate the role of stress on impression formation. Concerns about appearing prejudiced are known to be associated with increased physiological stress reactivity as measured by cortisol (Bijleveld *et al.*, 2012; Trawalter *et al.*, 2012). Although stress has been shown to impair cognitive processes relevant to intergroup decision-making (Arnsten, 2009), it remains unknown how stress and motivation interact to influence person evaluation. Additionally, it is unclear how acute increases in cortisol levels (i.e. stress) stemming from concerns about the social consequences of appearing prejudiced would interact with known status-related changes in cortisol (among other hormones: Carré *et al.*, 2013; Pornpattananangkul *et al.*, 2014; Hamilton *et al.*, 2015; Mehta and Prasad, 2015; Ligneul and Dreher, 2017). These important questions lie at the heart of the relatively new but growing field of social neuroendocrinology (for reviews, see McCall and Singer, 2012; Hamilton *et al.*, 2015).

Conclusion

At present, there are few empirical studies examining the intersections of race and status in person evaluation (but see Jussim *et al.*, 1987; Kirby, 1999; Moore-Berg *et al.*, 2017). Addressing this gap in social neuroscience, the present research revealed that White perceivers' EMS altered neural processing of a non-racial attribute (viz., status) during person evaluation, independently of race. Specifically, results highlight that EMS may attenuate positive evaluations and/or the salience of high status. Future work is needed to characterize how regions associated with reward/salience (NAcc), person evaluation (VMPFC) and threat/relevance (amygdala) interface with the greater prejudice control network (Amodio, 2014) as a function of perceiver motivation and stress levels.

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Supplementary data

Supplementary data are available at *SCAN* online.

Conflict of interest. None declared.

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