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"Yuck, you disgust me!" Affective bias against interracial couples

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HIGHLIGHTS

- Bias against interracial romance is correlated with self-reported feelings of disgust.
- Interracial couples elicit a neural disgust response among observers – as indicated by increased insula activation.
- Manipulating state disgust leads to implicit dehumanization of interracial couples.
- Findings suggest that meaningful social units (e.g., couples) influence person perception.

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ABSTRACT

The current research expands upon the sparse existing literature on the nature of bias against interracial couples. Study 1 demonstrates that bias against interracial romance is correlated with disgust. Study 2 provides evidence that images of interracial couples evoke a neural disgust response among observers – as indicated by increased insula activation relative to images of same-race couples. Consistent with psychological theory indicating that disgust leads to dehumanization, Study 3 demonstrates that manipulating disgust leads to implicit dehumanization of interracial couples. Overall, the current findings provide evidence that interracial couples elicit disgust and are dehumanized relative to same-race couples. These findings are particularly concerning, given evidence of antisocial reactions (e.g., aggression, perpetration of violence) to dehumanized targets. Findings also highlight the role of meaningful social units (e.g., couples) in person perception, an important consideration for psychologists conducting social cognition research.

The Supreme Court overturned anti-miscegenation laws >40 years ago (Loving v. Virginia, 1967) and recent surveys suggest that most Americans are accepting of interracial romance. According to the most recent Pew Research data, only 11% of the American public still explicitly disapproves of interracial marriage (Wang, 2012). Yet, when people are asked about their approval of interracial romances involving close family members, rates of disapproval are considerably higher. Across studies, 16%–37% of White Americans admit moderate to strong disapproval of close relatives engaging in interracial romances with Blacks (Bobo, 2004; Golebiowska, 2007). Historically, White Americans have been least accepting of interracial romances between Whites and Blacks (Porterfield, 1982; Romano, 2003), and this tendency continues to emerge in contemporary public opinion polls (Pew Research Center, 2010). Given societal norms prohibiting the expression of racial prejudice (França & Monteiro, 2013), there is good reason to believe that rates of disapproval are underestimated. Evidence suggests that Whites' implicit racial attitudes tend to be considerably more biased than their explicit racial attitudes (Nosek, Banaji, & Greenwald, 2002). Yet, to our knowledge there is no published research using implicit or even indirect measures (i.e., those that do not explicitly inquire about acceptance of interracial romance/marriage) of bias against interracial couples.

We do know that Whites tend to be less accepting of interracial romance for themselves than for others (Herman & Campbell, 2012). Qualitative analysis of attitudes toward interracial romance shows that although most Whites report explicit approval of interracial romance, they go on to explain why they would avoid it for themselves (Childs, 2008). Recent findings from a large demographically representative survey of Americans ($N = 1000$) indicated that 38% of Whites were unwilling to engage in any type of romantic relationship with a Black person (Herman & Campbell, 2012). Moreover, data from actual online dating profiles in the U.S. showed that over 50% of White profile owners ($N = 633$) were unwilling to date Blacks (Yancey, 2009).

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Given the sparse psychological literature on responses to interracial romance and reliance upon explicit self-report measures, we argue that additional research is needed to understand and quantify bias against interracial romance, and interracial couples. Investigating the emotions that underlie bias against interracial romance may be particularly important given meta-analytical evidence that affective reactions are much more strongly related to prejudice than attitudes, and more predictive of discrimination (Talaska, Fiske, & Chaiken, 2008). Interracial romances have historically been viewed as unnatural and impure (Pascoe, 2009; Phoenix & Owen, 2005). Regarded as morally wrong, interracial sexual encounters were considered to be a violation of racial and sexual purity (Dunleavy, 2004; Pascoe, 2009; Phoenix & Owen, 2005). Viewed through the lens of the moral foundations literature, such perceived violations of purity would be expected to elicit a disgust response (Haidt, 2003). This is supported by experimental evidence indicating that purity violations, such as breaking dietary or sexual taboos, elicit affective disgust reactions (e.g., Horberg, Oveis, Keltner, & Cohen, 2009; Rozin, Lowery, Imada, & Haidt, 1999). Moreover, so-called "bodily moral disgust" is exclusively elicited by violations of sexual norms (Russell & Giner-Sorolla, 2013). Historical evidence suggests that interracial romances were, in fact, characterized as disgusting (Jones, 2004). This sentiment has also been echoed in recent times, for example a *Washington Post* opinion column asserted that New York mayor Bill de Blasio's interracial family elicits "a gag reflex" among conservatives (Cohen, 2013).

The role of disgust may be particularly important given the associative properties of the disgust response (Russell & Giner-Sorolla, 2013), which are distinct from other negative emotions. Specifically, individuals who violate purity norms (eliciting a disgust reaction) are not just penalized for their violation; the individuals themselves are then associated with disgust and labeled as "disgusting." In contrast, individuals who violate fairness norms (eliciting an anger reaction) are typically only penalized for their specific violation. Thus, if interracial romance elicits disgust that could result in interracial couples being perceived as disgusting, which may predict prejudice and discriminatory treatment associated with an affective disgust response.

Disgust acts as a motivational force to distance oneself from people, places, or things (Rozin, Haidt, & McCauley, 2008). In this way, disgust serves an important evolutionary function, by motivating people to avoid contamination with potential pathogens. Thus, when social targets are associated with disgust it can result in them being perceived as unclean, animal-like, or even subhuman. Previous research shows that disgusting targets tend to elicit the most extreme kind of prejudice, known as dehumanization (Harris & Fiske, 2006; Sherman & Haidt, 2011). This kind of prejudice involves denying people of their full humanity, often treating them as nonhuman animals or even objects (Haslam, 2006). For example, Harris and Fiske (2011) found that people neglect to consider the thoughts and feelings of disgust-evoking targets. Other research has shown that participants show a marked lack of neural activity in social processing areas of the brain (e.g., the medial prefrontal cortex) when viewing extreme disgust-eliciting targets (e.g., homeless people and drug addicts; Harris & Fiske, 2006). Thus, if interracial couples elicit disgust dehumanization could be a result.

1. Overview of studies

The current research was designed to further develop our understanding of bias against interracial romance. Specifically, we aimed to examine whether *interracial romances* elicit disgust. In Study 1 we investigated the correlation between self-reported acceptance of interracial romance and self-reported disgust associated with interracial romance, hypothesizing that increased disgust would be associated with decreased acceptance of interracial romance. Next, given that individuals who violate purity norms are often perceived as disgusting (Russell & Giner-Sorolla, 2013), in Study 2 we sought to determine whether *interracial couples* would elicit disgust. Previous research has indicated that racial outgroups may elicit disgust (Tapias, Glaser, Keltner, Vasquez, & Wickens, 2007). Study 2 was designed to test the hypothesis that interracial couples elicit a distinct form of disgust (associated with the violation of sexual taboos), that cannot be explained by a general racial outgroup disgust response. We predicted that interracial couples would elicit a disgust response that exceeded that of all types of same-race couples (i.e., White and Black). To avoid response bias issues (Dovidio, Kawakami, & Beach, 2001) we employed a neural response measure in Study 2, which provided evidence of the cognitive processes engaged when viewing interracial couples. We predicted that interracial couples would evoke neural activation indicative of a disgust response (i.e., insula activation).

Next, given the theoretical link between disgust and dehumanization, we sought to examine (1) whether interracial couples are dehumanized relative to same-race couples and (2) whether heightened state disgust would increase dehumanization. To do this, in Study 3, we administered an implicit measure of dehumanization of interracial couples (relative to same-race couples) and examined whether implicit dehumanization differed between those who experienced a disgust induction and those in a control condition. Thus, in Studies 2 and 3 we attempted to establish a causal chain (Spencer, Zanna, & Fong, 2005), such that Study 2 was designed to provide causal evidence that interracial couples elicit disgust and Study 3 to test whether disgust leads to dehumanization of interracial couples. We hypothesized that interracial couples would elicit a disgust response and that heightened state disgust would increase dehumanization of interracial couples. Utilizing a behavioral measure of implicit dehumanization in Study 3 permitted us to recruit a substantially larger (and slightly more generalizable) sample and include a between subjects manipulation. Moreover, by employing multiple methods across studies (self-report, neural responses, implicit cognitive associations) we positioned our studies to establish converging evidence that interracial couples elicit a disgust response that translates into implicit dehumanization of interracial couples.

We chose to limit our investigation to Black-White interracial romances because previous research indicates that Whites show the strongest opposition to Black-White interracial couples (Golebiowska, 2007). Furthermore, given evidence that disgust is associated with disapproval of gay people (e.g., Inbar, Pizarro, Knobe, & Bloom, 2009; Terrizzi, Shook, & Ventis, 2010), we chose to avoid adding an additional layer of complexity by restricting our investigation to heterosexual couples. We report all measures, manipulations, and exclusions in the studies reported in this manuscript.

2. Study 1

Study 1 was designed to determine whether acceptance of interracial romance and disgust are related. We anticipated a relatively strong negative correlation, such that those who were least accepting of interracial romance would be most disgusted by them. We also sought to assess whether this relationship varies as a function of partner gender, thus we investigated attitudes and emotions separately for couples made up of a Black man and a White woman and couples made up of a White man and a Black woman. Although we did not anticipate any sizeable differences as a function of which partner is White (man or woman) and which partner is Black (man or woman), we took this approach to verify that this was the case.

2.1. Method

2.1.1. Participants

Undergraduate students ($N = 163$) were recruited from the psychology subject pool at a large public university in the Midwestern United States. Data collection concluded once we exceeded the target sample size of 150. Eleven participants failed to provide complete data for the key variables of interest, leaving a sample of 152 (48% men). Of

the participants that reported their age ($n = 132$), mean age was 19.22 years ($SD = 1.55$). Most participants identified as White (87%) the remainder of participants self-identified as Latino (5%), Asian (3%), Black (3%), or some "other" race (2%). As part of the subject pool, participants were awarded course credit for participating in this study. The university's institutional review board approved all study procedures.

2.1.2. Materials and procedure

Participants accessed the study online and provided informed consent before moving on to the main survey. Participants were asked to rate how disgusted they feel about a "Black man engaging in a romantic relationship with a White woman" and a "White man engaging in a romantic relationship with a Black woman" on a sliding scale ranging from 1 (*clearly does not describe my feelings*) to 100 (*clearly describes my feelings*). These items were imbedded among a series of other affective items (happy, delighted, and angry) in an attempt to conceal our hypotheses. Next, participants rated acceptance of romantic relationships between (a) Black men and White women and (b) White men and Black women on a scale from "*not at all acceptable*" (−5) to "*completely acceptable*" (5),[1] and responded to demographic items. We also asked participants to report on their own willingness to engage in interracial romance (Herman & Campbell, 2012). Participants were asked whether they would "date a Black person," "live with a Black person," "marry a Black person," and "have a child with a Black person." Response options included: "it's not a good idea," "I would not, but it is okay for others," "I would do this," and "I have done this." See supplemental materials for full list of items participants completed. After completing the online survey participants were thanked and awarded extra credit.

2.2. Results and discussion

Fifty percent of non-Black participants reported that they would be willing to date a Black person and an additional 33% said that although they would not they thought it was ok for others to do. However, fewer than 10% of non-Black participants had ever dated a Black person. See Table 1 for full descriptive statistics for non-Black participants ($n = 148$). Over 68% reported willingness to live with a Black person, although we suspect that participants were envisioning a roommate situation (rather than cohabitation with a dating partner), because a considerably larger percentage of participants were willing to do this than date a Black person.

Consistent with previous findings, mean levels of explicit acceptance were fairly high for Black men with White women ($M = 3.79$, $SD = 2.47$) and White men with Black women ($M = 3.82$, $SD = 2.41$). Mean levels of disgust were quite low for both Black men with White women ($M = 6.18$, $SD = 17.97$) and White men with Black women ($M = 6.82$, $SD = 19.67$). The Pearson correlation between acceptance and disgust for Black men and White women indicated a strong negative relationship, $r(152) = -0.62$, $p < 0.001$, 95% CI [−0.70, −0.50].[2] The Pearson correlation between acceptance and disgust for White men and Black women indicated a very strong negative relationship, $r(152) = -0.71$, $p < 0.001$, 95% CI [−0.78, −0.62]. See Fig. 1 for scatterplots.

Results of Study 1 provided initial support for our hypothesis – that disgust is associated with reduced acceptance of Black-White interracial romance. At the same time our findings indicate that participants were skewed toward acceptance, consistent with previous literature showing high rates of explicit acceptance of interracial romance (Wang, 2012). Thus, the results of Study 1 indicate that although people tend to report fairly high acceptance of interracial romance, disgust is strongly associated with bias against interracial romance. It is important to note, however, that the measures employed in Study 1 required participants' insight into their own emotional response to interracial romance and willingness to report it. Given that contemporary egalitarian norms prohibit the expression of racial biases (França & Monteiro, 2013), we suspect that not all participants that harbor biases were willing to acknowledge and report them. Nonetheless, Study 1 provided strong support for our initial hypothesis, that disgust is associated with reduced acceptance of interracial romance. However, given the correlational design, we could not know about the causal relationships involved. Most importantly, we could not be sure whether interracial romance actually elicits a disgust response.

Table 1
Descriptive statistics on the percentages of non-Black participants ($n = 148$) who were willing to engage in various interracial relationships with Black people.

	It's not a good idea	I would not, but it is okay for others	I would do this	I have done this
Date	6.76%	33.11%	50.68%	9.46%
Live with	6.08%	16.89%	68.92%	8.11%
Marry	7.43%	35.14%	57.43%	0%
Have a child with	8.78%	35.14%	56.08%	0%

3. Study 2

Study 2 was designed to determine whether interracial couples elicit a disgust response. Consistent with evidence that those who violate purity norms are perceived as disgusting (Russell & Giner-Sorolla, 2013), we predicted that interracial couples would elicit a heightened disgust response among observers. We chose to employ a neural response measure to obtain information about participants' instantaneous emotional response to interracial couples that was not contingent upon participants' own awareness or willingness to report. Although evidence from explicit measures indicates that bias against interracial romance is fairly uncommon (Study 1; Wang, 2012), we anticipated that a neural response measure would reveal substantially higher rates of bias – consistent with the literature on explicit relative to implicit racial attitudes (Nosek et al., 2002).

Considerable evidence indicates that the insula is preferentially active when participants experience disgust (e.g., Borg, Lieberman, & Kiehl, 2008); in fact, some evidence indicates that damage to the insula can actually impair disgust processing (Calder, Keane, Manes, Antoun, & Young, 2000). Although insula activation is not exclusively indicative of disgust (e.g., it has also been associated with empathy and uncertainty; Singer, Critchley, & Preuschoff, 2009), it is often thought of as a neural marker of disgust (Chapman & Anderson, 2012). Thus, insula activation is particularly well-suited to serve as an index of disgust response to different types of couples. Specifically, we tested whether viewing images of interracial couples would produce neural evidence of disgust. To do this we tracked neural activity, using event-related potentials (ERPs), while participants viewed a series of images of same-race and interracial couples. Previous findings indicate that insula activation is correlated with P300 amplitude (Horovitz, Skudlarski, & Gore, 2002), thus we targeted the temporal window associated with the P300 component (200–600 ms) and focused our analyses on insular source activation. Brain source activation is most commonly investigated with fMRI, due to its excellent spatial resolution. However, ERP is actually a more direct measure of neural activity (Amodio, Bartholow, & Ito, 2014) and high-density ERP can be used to identify activation of neural sources – showing considerable convergence with fMRI findings (Amodio et al., 2014; Corrigan et al., 2009; Mulert et al., 2004). We hypothesized that, relative to same-race couples, interracial couples would evoke increased activity in the insula, indicative of a heightened disgust response.

[1] Participants also completed a general item on their acceptance of "romantic relationships between Black people and White people."

[2] Correlation analyses were also conducted for just the White participants, and they were nearly identical: Black man/White woman $r = -0.64$, White man/Black woman $r = -0.75$.

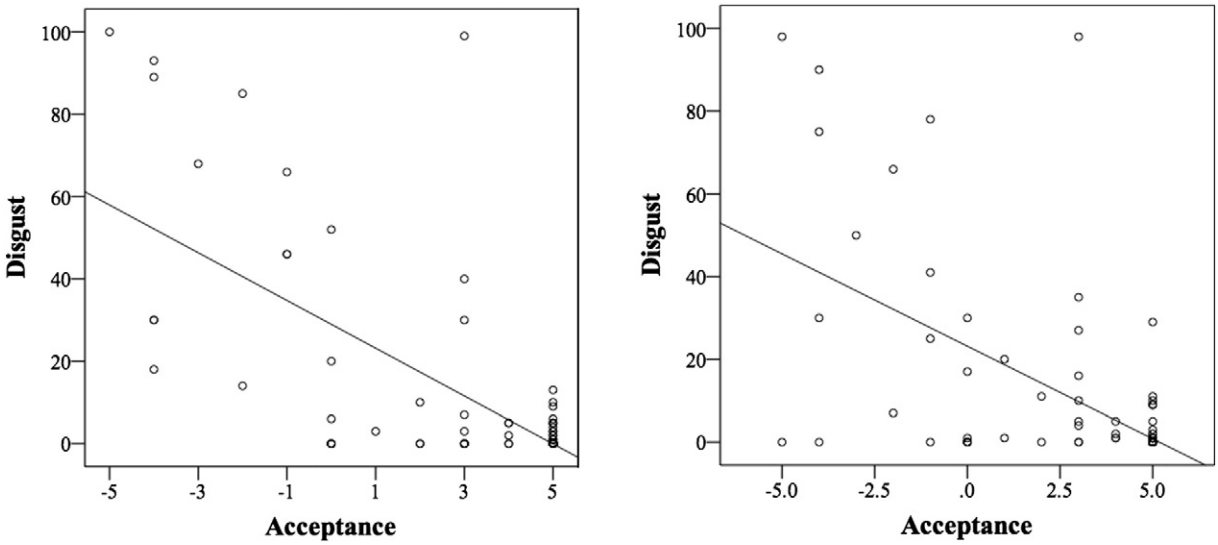

Fig. 1. Scatterplots for the correlation between interracial romance acceptance and disgust for romances between White men and Black women and romances between Black men and White women. Higher values indicate more acceptance and disgust, respectively.

3.1. Method

3.1.1. Participants

Nineteen undergraduate students (11 men) were recruited from the psychology subject pool at a large public university in the Midwestern United States. Previous ERP research reports large effect sizes for the effect of target race on the P300 component (e.g., Dickter & Bartholow, 2007; Lv, Yan, Tao, & Zhao, 2015). Power analysis, carried out using G*Power software (Faul, Erdfelder, Lang, & Buchner, 2007), indicated that in order to detect a large effect ($f = 0.40$) for a within-subjects design (alpha of 0.05 and power = 0.80) a sample of 8 is needed. However, we chose to recruit a substantially larger sample ($N = 18$), which would allow us to detect condition differences even if the effect size were more moderate ($f = 0.25$). Data collection concluded once we exceeded the target sample size of 18 (one additional participant was included to ensure that we had usable ERP data for at least 18 participants). No statistical analyses were conducted before the conclusion of data collection. Given the repeated measurements and high correlations ($rs > 0.75$[3]) between averaged ERP waveforms (and extracted source activation values) in ERP studies, particularly those using high-density electrode nets, relatively small participant samples are sufficient for detecting statistically significant effects. The mean age of participants was 20.38 years[4] ($SD = 2.13$). Seventeen participants self-identified as White, one participant identified as Latino, and one participant identified as a member of another non-specified racial or ethnic group. As part of the subject pool, participants were awarded course credit for participating in this study. The university's institutional review board approved all study procedures and each participant gave written informed consent prior to participation.

3.1.2. Materials

Participants viewed a total of 200 images of heterosexual couples made up of 100 interracial couples (50 Black men with White women and 50 White men with Black women) and 100 same-race couples (50 Black couples and 50 White couples). All images were wedding and engagement photos of real couples taken by professional photographers in the United States. Images were obtained from a variety of Internet sources that indicated that the pictures were free to use and distribute without copyright restrictions.[5] Image ratings during a pilot test did not differentiate between conditions on attractiveness ($p = 0.710$) and the extent to which the couples were perceived to be in love ($p = 0.847$).

3.1.3. Procedure

Participants were seated facing a computer monitor adjusted to be 1 m from the midline of the participant's face. A 256 high-density AgAgCl electrode Hydrocel Geodesic Sensor Net and NetStation 4.4.2 software (Electric Geodesics Inc., Eugene, OR) recorded the continuous electroencephalography (EEG) for each participant during the task. To ensure that visual photometric properties were equivalent across conditions, luminance (i.e., brightness of the image) was measured for each image using custom software in MATLAB to extract RGB values. A one-way ANOVA indicated there were no differences in luminance across conditions, $F(3, 207) = 1.51$, $p = 0.21$. Thus, the visual properties of couple conditions were equivalent. Testing began once all electrode impedances were below 60 kΩ, a standard level for this type of high-impedance amplifier and electrode system. During testing, continuous EEG was sampled unfiltered at 250 Hz and referenced to the vertex electrode. Following completion of the experiment, the EEG signals were filtered off-line using 0.3–30 Hz bandpass. Event-related potentials (ERP) were time-locked to the onset of each image. Each ERP trial was segmented to include a 200 ms pre-stimulus period (baseline) and a 1000 ms post-stimulus onset epoch. Artifact rejection removed ERPs contaminated by eye artifacts and motor movements (i.e., defined as voltage shifts over 150 μV). Electrodes with poor signal quality on >10% of trials were replaced using adjacent electrode spline interpolation. Finally, all signals were re-referenced to an average of all electrodes, baseline-corrected, and then signal-averaged separately for each condition and electrode site.

Photos (400 × 274 pixels) were presented in random order in the center of the screen which subtended a visual angle of 4.1 × 6.0°. We asked participants to rapidly indicate whether each of the newlywed couples should be included or excluded from a future study on relationships using a handheld keypad. We did this to encourage social evaluation, although we did not provide any evaluation criteria or indicate that there were any benefits associated with being selected for the study. Each photo was displayed for 2000 ms, during which participants were instructed to respond as quickly as possible, before a fixation-

[3] Examination of the obtained data indicated that source values for insula activation were highly correlated within the left hemisphere ($rs > 0.75$) and the right hemisphere ($rs > 0.83$). Moreover, achieved power for the key interaction of interest was 0.90.

[4] Three participants did not report their ages.

[5] Our list of images and sources is available upon request.

cross appeared for a 2000 ms inter-trial interval. The buttons used for response selections (left vs. right) were counterbalanced across participants. Before the experimental session began all participants demonstrated to the experimenter that they understood which buttons were used to "include" and "exclude" couples from the study. During the experimental session if a participant repeatedly failed to respond within 2000 ms, the experimenter paused the task and reminded the participant that they should respond as quickly as possible, before the photo disappeared. A short break after every 50 trials allowed each participant to move around in their seat and blink their eyes until they were ready to resume testing. Following completion of the ERP task participants provided demographic information and completed self-report items, including explicit acceptance of interracial romance and willingness to engage in interracial romance (see supplemental materials for additional measures), then they were credited for their participation.

3.1.4. ERP data processing and source localization

Given the association between the P300 and insula activation (Horovitz et al., 2002), we anticipated that the P300 component (approximately 200–600 ms) would be related to couple type. Averaged ERPs were submitted to principal components analysis (PCA), a common data-driven approach for independently identifying temporal windows of variability in the ERP (Molfese et al., 2013), to confirm the time window associated with the P300 component. The PCA derived two primary factors (accounting for ~85% of the overall variance), including an earlier occurring P300 component (116–560 ms) and a later occurring late slow wave component (492–1000 ms). Bartlett factor scores for these two factors were submitted to a 9 (scalp-clustered regions) × 2 (hemisphere) × 2 (couple type: interracial vs. same-race) repeated measures ANOVA to determine whether either temporal window was associated with variability as a function of couple type. Only the temporal window associated with the P300 component was related to couple type. Thus, subsequent analyses targeted the source estimation within the PCA-derived P300 component temporal window (116–560 ms). Extended details regarding ERP analysis, grand-mean waveform illustration, and PCA factor illustration are available in supplemental materials.

To extract source values a finite difference model (FDM) was applied via the GeoSource® software program (v2.0; Electrical Geodesics), which uses a forward modeling approach to accurately compute the electrode locations in relation to brain tissues. This approach has successfully been used to source localize activation in the insula in previous research (e.g., Crowley, Wu, Molfese, & Mayes, 2011; Murphy et al., 2009). FDM estimates were constrained by the Montreal Neurological Institute (MNI) average adult MRI database. Tissues volumes were parceled using 7-mm voxels, each serving as a dipole source location with three orthogonal orientations (in *x*-, *y*-, and *z*-orientations). The FDM applied estimations across a total of 2447 source dipole triplets. Conductivity values used in the FDM model included 0.25 S/m for brain, 1.8 S/m for cerebral spinal fluid, 0.018 S/m for skull, and 0.44 S/m for scalp (Ferree, Eriksen, & Tucker, 2000). Weighting was placed equally across locations with regularization carried out via Tikhonov (1×10^{-2}) using sLORETA as a constraint. Mean source amplitude within the insula[6] (BA 13; Dupont, Bouilleret, Hasboun, Semah, & Baulac, 2003) was extracted over the 116–560 ms post-stimulus onset temporal range. We also extracted values in an area that was expected to be unresponsive to couple type, the primary motor cortex (BA 4), to test for divergent validity. Source estimates were then submitted to a 2 (hemisphere) × 2 (couple type: interracial vs. same-race[7]) repeated measures ANOVA.

[6] Although the insula is comprised of Brodmann areas 13–16, NetStation Geosource software is only capable of providing source estimates for Brodmann area 13, thus only Brodmann area 13 was included in our analyses.

[7] We chose to combine both types of interracial couples and both types of same-race couples for analysis because the correlations observed in Study 1 were quite similar and we were interested in the overall differences between interracial and same-race couples.

3.2. Results and discussion

Explicit acceptance was high for Black men with White women ($M = 3.74$, $SD = 2.62$) and White men with Black women ($M = 3.79$, $SD = 2.42$), nearly identical to Study 1. Explicit willingness to engage in interracial romance was similar to the rates reported in Study 1 (see supplemental materials for full results).

Results of the insula source analysis revealed a significant interaction between hemisphere and couple type $F(1, 18) = 11.80$, $p = 0.003$, $\eta_p^2 = 0.40$.[8] Fig. 2 presents highly engaged (>0.1 nA) neural activation while viewing images of interracial versus same-race couples. Planned comparisons of couple type within hemisphere indicated that interracial couples evoked significantly more activation ($M = 0.095$, $SE = 0.008$) than same-race couples ($M = 0.086$, $SE = 0.008$) in the right insula, $F(1, 18) = 8.98$, $p = 0.008$, $\eta_p^2 = 0.33$. Extracted values for mean right insula activation are plotted in Fig. 3 for both kinds of same-race couple (Black, White) and both kinds of interracial couple (Black men with White women, White men with Black women). Right insula activation did not significantly differ for same-race White relative to same-race Black couples ($p = 0.299$) or Black men with White women relative to White men with Black women ($p = 0.251$). In the left insula activation did not vary as a function of couple type, $F(1, 18) = 0.65$, $p = 0.432$, $\eta_p^2 = 0.04$.

To establish divergent validity we submitted primary motor cortex source estimates to a 2 (hemisphere) × 2 (couple type: interracial vs. same-race) repeated measures ANOVA. Results revealed that neither the main effect of couple type $F(1, 18) = 0.96$, $p = 0.341$, $\eta_p^2 = 0.15$ nor the interaction between hemisphere and couple type was significant, $F(1, 18) = 1.32$, $p = 0.266$, $\eta_p^2 = 0.19$.

3.2.1. Relationship study selection

A multilevel model with random effects for both participants and stimulus images was used to determine whether couple type impacted selection for the relationship study. The SAS PROC GLIMMIX procedure (method = laplace) was used to model this binomial data, following the procedures outlined by Judd, Westfall, and Kenny (2012). Results indicated that couple type did effect selection for the relationships study, $F(1, 3532) = 7.27$, $p = 0.007$, 95% CI [0.08, 0.51], such that the probability of selection for the study was higher for same-race couples (*Probability* = 0.94, $SE = 0.04$) relative to interracial couples (*Probability* = 0.92, $SE = 0.05$). A separate multilevel model with random effects for both participants and stimulus images (SAS PROC MIXED procedure with Satterthwaite *df*) revealed that couple type also significantly influenced reaction times. Participants responded significantly faster when couples were same-race ($M = 987.90$ ms, $SE = 52.80$) relative to interracial ($M = 1020.32$ ms, $SE = 52.79$), $F(1, 198) = 9.69$, $p = 0.002$, 95% CI [−52.95, −11.88].

Study 2 provided physiological evidence that interracial couples elicit feelings of disgust. As hypothesized, participants showed significantly more insula activation while viewing images of interracial couples than while viewing images of (Black and White) same-race couples. This is consistent with literature indicating that the insula is preferentially active when people experience disgust (e.g., Chen et al., 2009; Jabbi, Bastiaansen, & Keysers, 2008; Parkinson et al., 2011), particularly so when it is sex-related (e.g., Borg et al., 2008). Moreover, there were no significant within condition differences in insula activation. In other words, same-race White couples and same-race Black couples evoked statistically equivalent levels of insula activation (as did the two types of interracial couples). Thus, our findings cannot be explained by the presence of racial outgroup members in the images, and are instead driven by a difference in responding to same-race versus interracial couples.

[8] We also conducted the analysis with only the White participants ($n = 17$) and there were no changes in statistical significance.

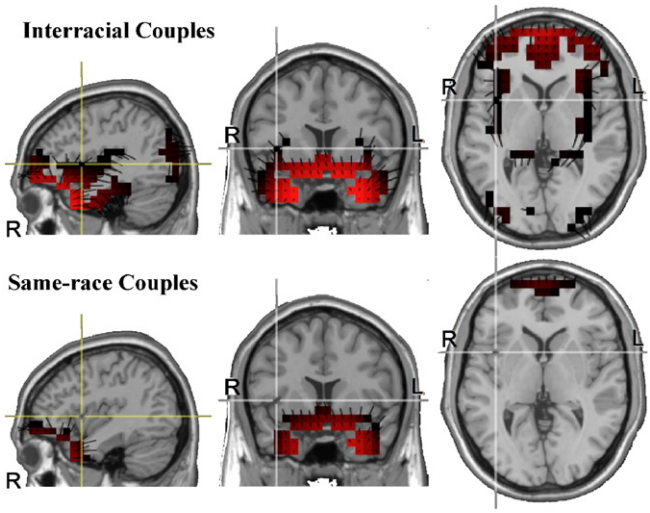

Fig. 2. Highly engaged neural activation (>0.1 nA) while viewing images of interracial versus same-race couples. Snapshots reflect the strength of activation between 0.1 nA (dark red, weak activation) to 1.0 nA (bright red, strong activation) at 200 ms post-stimulus onset. Crosshair is centered within the right insula for sagittal, coronal, and axial views. Abbreviations: R, Right hemisphere. L, Left hemisphere.

Although some studies show that disgust evokes bilateral insula activation (e.g., Stark et al., 2007; Wicker et al., 2003), others have found disgust response was specific to the right (e.g., Chen et al., 2009; Phillips et al., 1997), or left insula (e.g., Harris & Fiske, 2006). In the current study effects of couple type were only observed in the right insula. Thus, our findings are consistent with the larger body of work on insula response to disgust, which indicates that hemisphere of activation varies across samples and stimuli. Most commonly, neural activation is reported as a difference between the condition of interest and a control (e.g., fixation cross) or comparison condition. Thus, even in studies reporting no activation in a given area, most often that means that there was no *additional* activation relative to the control/comparison condition. In the current study we reported raw source values (rather than difference scores), thus the critical question is not whether any activation at all is evoked, but whether that level of activation differs across conditions. Insula activity was observed in response to both types of couples – although activation in the interracial couple condition was significantly greater. This is consistent with previous findings indicating that insula activation is not entirely absent when viewing non-disgust-evoking stimuli, but that insula activation is significantly greater for disgust-evoking stimuli relative to non-disgust-evoking stimuli (Harris & Fiske, 2006). Taken together with Study 1, our findings suggest that people are disgusted by interracial romance and that translates into a heightened disgust response when faced with interracial couples.

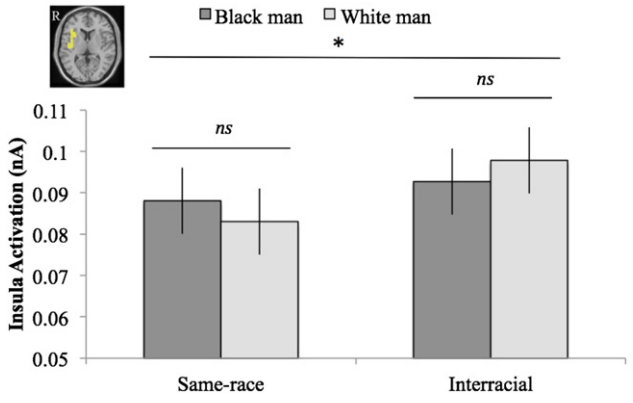

Fig. 3. Mean right insula activation in nanoamperes while viewing images of same-race (Black, White) and interracial (Black men with White women, White men with Black women) couples. The right insula (Brodmann Area 13) region of interest that was used for statistical extraction is illustrated in the inset image on a template brain. Interracial couples evoked more activation than same-race couples ($p = 0.008$), although mean activation did not significantly differ within the interracial ($p = 0.251$) or the same race condition ($p = 0.299$). Asterisk indicates significance of $p < 0.01$. Error bars represent standard errors of the means.

4. Study 3

The results of Studies 1 and 2 provided evidence that bias against interracial romance is not only correlated with feelings of disgust, but that viewing images of interracial couples evokes disgust at a neural level. Consistent with the literature on disgust and dehumanization, we hypothesized that interracial couples elicit a disgust response, which results in dehumanization of interracial couples relative to same-race couples. Study 2 provided causal evidence that interracial couples elicit disgust. In Study 3, we investigated whether heightened state disgust leads to dehumanization of interracial couples. This approach is consistent with the recommendations of Spencer et al. (2005) for establishing a causal chain. To test the second link in this causal chain we experimentally induced disgust, and then measured implicit dehumanization of interracial couples. Thus, we manipulated whether participants were primed with disgusting images or positive images before they completed an adapted version of the Implicit Associations Test (IAT), designed to measure implicit dehumanization of interracial couples. We hypothesized that there would be a general tendency to implicitly dehumanize interracial couples, relative to same-race couples, but that this effect would be larger among those who experienced the disgust induction.

4.1. Method

4.1.1. Participants

Undergraduate students were recruited from the psychology subject pool at a large public university in the Midwestern United States. We set a target sample size of 100 participants per condition, consistent with recent recommendations for adequately powering behavioral studies (Fraley & Vazire, 2014; Vazire, 2014). However, to maximize statistical power and ensure that we would have usable data from at least 200 participants (100 participants per cell) we allowed data collection to continue through the end of the academic semester. We received complete data from a total of 240 participants. Fourteen participants were excluded from analysis because they responded in <300 ms on >10% of trials, they responded incorrectly on >30% of trials, or they responded incorrectly on >40% of trials in either IAT block (Nosek et al., 2007). The final sample used for analysis included 226 (75% women) participants (M age = 19.94[9], SD = 2.09). Most participants identified as White (87%), and the remainder self-identified as Black (4%), Latino (4%), Asian (4%), or another race (1%). As part of the subject pool, participants were awarded course credit for participating in this study. The university's Institutional Review Board approved all materials and procedures.

4.1.2. Materials and procedure

This study comprised a one-way between groups design with two levels (disgust prime vs. control prime[10]). Participants accessed the study online and provided consent before moving on to report demographics and participate in one of the two randomly assigned conditions. In the disgust prime condition participants viewed a series of 10 disgusting images (e.g., a dirty toilet, a person vomiting) taken from the International Affective Picture System (IAPS; Lang, Bradley, &

[9] One participant did not report age.

[10] A third condition (fear prime) was also included, however due to lack of theoretical relevance it is not reported here. Full results (including the fear prime condition) are provided in the supplemental section.

Cuthbert, 2008). In the control prime condition participants viewed a series of 10 images of natural landscapes and cityscapes taken from the IAPS. IAPS codes were: 1271, 1274, 7359, 7360, 9301, 9302, 9320, 9321, 9322, 9326 (disgust), 5260, 5270, 5301, 5600, 5700, 7502, 7510, 7570, 7580, 7650 (positive). In order to ensure participants were actually paying attention to the images they were asked to rate how much they enjoyed viewing each image on a scale from 0 (not at all) to 100 (very much). After viewing the ten images they were asked to use a free response format to describe the emotions they experienced while viewing the images. Images in the disgust condition were rated as significantly less enjoyable to view ($M = 6.73$, $SD = 6.92$) than images in the control condition ($M = 63.27$, $SD = 12.52$), $F(1, 224) = 1740.00$, $p < 0.001$. Examination of participants' descriptions of the emotions they experienced while viewing the images indicated that the prime successfully induced disgust as participants used words such as *disgusted*, *sickened*, *grossed-out*, and *repulsed* to describe their emotions. In the control condition participants' used words such as *happy*, *peaceful*, *tranquil*, and *enjoyment* to describe their emotions.

After priming, participants moved on to complete a version of the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) adapted to assess dehumanization of interracial couples. In this version of the IAT participants simultaneously categorized same-race and interracial couples and the concepts "human" and "animal." IAT stimuli consisted of 6 color images of Black and White same-race couples (a subset of those used in Study 2), 6 color images of Black-White interracial couples (a subset of those used in Study 2), 6 black silhouettes of humans on a white background, and 6 black silhouettes of nonhuman animals on a white background (see Appendix A for examples). Category labels appeared in the upper left and right hand corners of the computer screen and participants used the "e" and "i" keys on their keyboard to categorize target stimuli into the left or right category, respectively. The category "animal" always appeared on the left and the category "human" always appeared on the right, thus only the location of couple-type varied across blocks. Participants completed two blocks of 80 trials, each preceded by a series of training trials in which participants practiced categorizing stimuli in the correct locations. First, participants completed a block in which they categorized interracial couples with nonhuman animals and same-race couples with humans. Second, they completed a block in which they categorized same-race couples with nonhuman animals and interracial couples with humans. A red "X" appeared in the center of the screen immediately following incorrect categorizations, indicating that a mistake was made. Participants were then required to correctly categorize the target before moving on to the next trial.

4.2. Results and discussion

4.2.1. Analysis strategy

The most common approach to IAT analysis involves the calculation of *D*-scores, standardized effect sizes for each participant (Greenwald, Nosek, & Banaji, 2003). Yet, this approach reduces statistical power and removes meaningful variance by reducing the hundreds of data points that make up the IAT to a single data point per participant (Van Bavel & Cunningham, 2009). Multilevel modeling provides an appropriate alternative that does not suffer from these limitations because it incorporates and adjusts for each participant's reaction time on each individual trial using random effects of both participants and stimuli, greatly reducing Type I error rates (Judd et al., 2012). In the current study the SAS 9.3 PROC MIXED procedure (with Satterthwaite *df*) was used to implement multilevel models with random effects for both participants and IAT stimuli following the procedures outlined by Judd et al. (2012). Prior to analysis, reaction times >1.5 times the interquartile range above the third quartile and 1.5 times the interquartile range below the first quartile were identified as outliers (Tukey, 1977). This approach to outlier elimination produces a non-skewed distribution of reaction times, unlike some other approaches (e.g., removing reaction times <400 ms or >10.000 ms). Of the original set of responses 6.11% were identified as outliers and removed.

4.2.2. Effects of prime on implicit bias

Between subjects prime condition, IAT block, and their interaction, were entered as the sole predictors in the model. The main effect of IAT block was significant, $F(1, 34{,}000) = 425.74$, $p < 0.001$ 95% CI [−81.69, −65.21], indicating greater ease categorizing interracial couples with nonhuman animals and same-race couples with humans. In other words there was a general tendency to implicitly dehumanize interracial couples relative to same-race couples. This effect was qualified by an interaction with condition, $F(1, 34{,}000) = 17.64$, $p < 0.001$ 95% CI [13.25, 36.44] (see Fig. 4). Follow-up tests indicated that in both the control ($t(34{,}000) = 11.68$, $p < 0.001$) and the disgust condition ($t(34{,}000) = 17.48$, $p < 0.001$) participants demonstrated significant dehumanization of interracial couples relative to same race-couples. However, implicit dehumanization of interracial couples was significantly greater in the disgust prime condition, $t(34{,}000) = 4.20$, $p < 0.001$, 95% CI [13.25, 36.44]. Limiting the sample to just the White participants did not influence statistical significance tests.

The findings of Study 3 confirmed our hypothesis that interracial couples would be dehumanized. Our findings indicate that interracial couples are implicitly dehumanized relative to both Black and White same-race couples. In other words, participants were quicker to associate interracial couples with nonhuman animals and same-race couples with humans, in contrast to associating interracial couples with humans and same-race couples with nonhuman animals. Moreover, given evidence that disgust leads to dehumanization (e.g., Sherman & Haidt, 2011), we also included an experimental disgust induction. We hypothesized that implicit dehumanization would be particularly strong among participants who experienced the disgust induction. As predicted, those in the disgust induction condition showed even greater dehumanization of interracial couples – consistent with the conceptual link between disgust and dehumanization.

4.3. General discussion

Overall, the current findings suggest that despite high levels of explicit acceptance (Wang, 2012), bias against Black-White interracial romance persists in the U.S. We employed multiple methods, including self-reports, neural responses, and implicit cognitive associations, which provided converging evidence that interracial couples elicit a

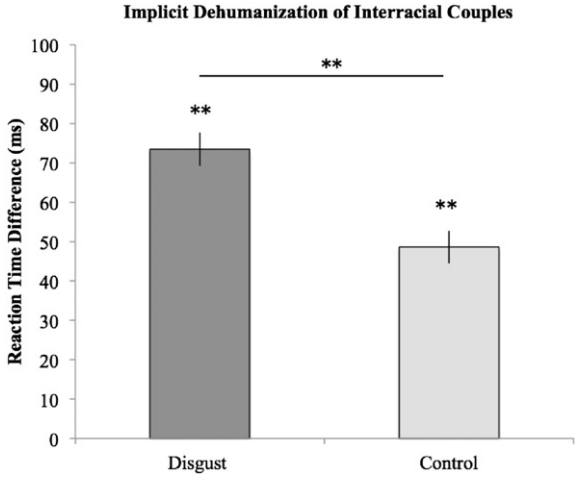

Fig. 4. Implicit dehumanization of interracial couples broken down by experimental condition (Disgust prime vs. Control prime). Higher values on the y-axis indicate greater implicit dehumanization of interracial couples. Interracial couples were implicitly dehumanized relative to same-race couples in the disgust and control conditions, although this effect was greater in the Disgust prime condition. Asterisks indicate significance of $p < 0.001$. Error bars represent standard errors of the means.

disgust response that translates into implicit dehumanization of interracial couples. We found main effects of disgust and dehumanization without controlling for individual variability in attitudes toward interracial romance. Thus, our findings suggest that affective bias against interracial romance is not just limited to a small subset of the population (i.e., 11% of the public, Wang, 2012).

Violations of purity (Haidt, 2003; Horberg et al., 2009) and moral violations of a sexual nature (Rozin et al., 1999; Russell & Giner-Sorolla, 2013) tend to elicit disgust. Given that interracial romance has historically been viewed as a moral affront to purity (Dunleavy, 2004), we hypothesized that disgust could play an important role in bias against interracial romance. Study 1 indicated that bias against interracial romance is highly correlated with feeling disgusted by interracial romance. Evidence suggests that those who violate purity norms (i.e., engage in disgusting acts) are themselves perceived as disgusting (Russell & Giner-Sorolla, 2013), in Study 2 we examined whether interracial couples would evoke an instantaneous neural disgust response. The anterior insula (BA 13) is generally involved in the experience of disgust (e.g., Chen et al., 2009; Jabbi et al., 2008; Parkinson et al., 2011). Moreover, some evidence suggests that the insula is particularly sensitive to sex-related disgust (Borg et al., 2008), which is pertinent to our participants' task of viewing and judging newlywed couples. Consistent with this literature, Study 2 participants showed significantly more right insula activation while viewing images of interracial couples relative to same-race couples. Although there is previous literature indicating that outgroup members tend to elicit disgust (Rozin, Haidt, McCauley, & Imada, 1997; Tapias et al., 2007), our results indicated no significant difference in disgust response (i.e., insula activation) evoked by same-race White couples and same-race Black couples. The two types of interracial couples also did not differ significantly in disgust response evoked. Yet, interracial couples evoked significantly more insula activation than same-race couples (Black and White), indicating that participants experienced significantly more disgust when viewing interracial couples than when viewing same-race couples. Thus our findings are driven by a difference in responding to same-race versus interracial couples rather than the presence or absence of racial outgroup members in the images.

It is, however, important to note that insula activation is not exclusively indicative of disgust; insula activation has also been associated with other psychological experiences such as empathy and uncertainty (Singer et al., 2009). Although our findings suggest that participants were experiencing a disgust response, as with all neuropsychological studies, we cannot be certain that the insula activation observed in the current study was a result of disgust. Nonetheless, these results support the hypothesis that interracial couples elicit disgust, which could have real-world implications for how interracial couples are treated, given that negative affect predicts both prejudice and discrimination (Talaska et al., 2008).

Study 3 built upon these findings to examine whether disgust translates into dehumanization of interracial couples. Numerous studies have shown that disgust leads to dehumanization (Haslam & Loughnan, 2014; Hodson & Costello, 2007; Sherman & Haidt, 2011). Disgust motivates people to distance themselves from disgusting targets (Rozin et al., 2008), who are often perceived as dirty and animal-like (Haslam & Loughnan, 2014). We hypothesized that interracial couples elicit feelings of disgust, which results in dehumanization of interracial couples. Indeed, our findings indicate that interracial couples are implicitly dehumanized relative to same-race couples. Taken together, Studies 2 and 3 establish a causal chain, showing that interracial couples elicit disgust (Study 2) and that elevated state disgust leads to increased dehumanization of interracial couples (Study 3). Moreover, implicit dehumanization of interracial couples emerged among those in both the disgust condition and the control condition, indicating a general tendency for interracial couples to elicit disgust and be dehumanized relative to same-race couples. This is particularly striking given evidence that Blacks are implicitly dehumanized relative Whites (Goff, Eberhardt, Williams, & Jackson, 2008; Goff, Jackson, Di Leone, Culotta, & Ditomasso, 2014). Results of the current study indicate that relative to White *and* Black same-race couples, interracial couples are implicitly dehumanized.

In sum, although most of the extant evidence suggests that people in the U.S. are explicitly accepting of interracial romance (e.g., Wang, 2012), our findings suggest that there may still be considerable affective and implicit bias against interracial couples. Meta-analytical findings indicate that the relationship between emotional biases (e.g., disgust) and discrimination is two times stronger than the relationship between stereotypes or beliefs and discrimination (Talaska et al., 2008). Moreover, affective biases predict discriminatory behavior, whereas stereotypes and beliefs do not. Therefore the finding that interracial couples elicit disgust suggests that interracial couples may face prejudice and discrimination. Given that most Americans explicitly profess acceptance of interracial romance, discrimination is presumably fairly discrete, yet may still have a considerable impact on interracial couples. For example, in Study 2, interracial couples were significantly less likely to be selected to participate in the relationships study (relative to same-race couples) ostensibly being conducted in the lab. Although participation in the relationships study was not presented as a clearly beneficial outcome, these findings suggest a behavioral tendency to discriminate against interracial couples. The literature on aversive racism suggests that although people strive to be (or at least appear) non-biased in contemporary society, biases emerge in ambiguous situations (Gaertner & Dovidio, 1986). We argue that the same principles likely apply to interracial couples, such that in unambiguous contexts people will avoid demonstrating prejudice or discrimination against interracial couples. Yet, when the context is ambiguous, biases may emerge. For example, a hotel manager may not refuse to rent a room to an interracial couple, but may neglect to mention that there is only one room left before the couple steps out to park their car. Future studies could investigate whether discrimination against interracial couples takes place in ambiguous and unambiguous circumstances.

Furthermore, the finding that interracial couples are implicitly dehumanized suggests that interracial couples may be denied complex mental states and deprived of empathy and social consideration (Hodson & Costello, 2007; Sherman & Haidt, 2011). Perhaps most concerning, is evidence that people demonstrate less prosocial behavior and more antisocial behavior toward dehumanized targets (Haslam & Loughnan, 2014). People are less likely to help (Cuddy, Rock, & Norton, 2007) and more likely to use aggression and perpetrate violence against dehumanized targets (Haslam & Loughnan, 2014). For example, men who implicitly dehumanize women show a greater proclivity to sexually assault and harass women (Rudman & Mescher, 2012). There is also evidence of a causal relationship between dehumanization and aggression. Goff et al. (2008) found that participants who were subliminally primed to think about apes (promoting dehumanization of Blacks) were more accepting of police violence against a Black suspect. Thus priming the implicit association between Black people and apes significantly increased acceptance of violence against Black people. Moreover, there is evidence that some groups are blatantly dehumanized, such that they are considered to be less evolved and civilized than others (Kteily, Bruneau, Waytz, & Cotterill, 2015). Blatant dehumanization, such as this, predicts support for overt aggression and violence. Indeed, there have been recent incidents of targeted violence against interracial couples (e.g., Gardiner, 2013; Murphy, 2013; Teo, 2009). Yet, it is likely that antisocial reactions to interracial couples typically manifest more subtly, such as refusing to perform marriages for interracial couples (Deslatte, 2010) or denying membership to social and community groups (e.g., churches; Associated Press, 2011). Nonetheless, subtle antisocial reactions have the potential to adversely impact interracial couples, especially as they accumulate over time.

Another important contribution of the current research is that it demonstrates the importance of investigating reactions to meaningful social units. Most of the social psychological literature is centered on

social responses to individuals and large groups (e.g., based on race or religion), yet there has been little investigation into the responses elicited by meaningful social units, such as romantic couples. In the current study, we found evidence of disgust and dehumanization of interracial couples relative to both White and Black same-race couples. Thus, our findings demonstrate a reaction that is specific to the pairing of members of different racial groups, as opposed to a bias against members of a specific racial group. This suggests that if either member of an interracial couple were evaluated individually they would not elicit disgust or be dehumanized, yet when paired together they elicit a psychological response that is unique to the pairing. Our findings corroborate other recent work illustrating the importance of investigating meaningful social units (Kille & Tse, 2015), which may elicit unique reactions that are not captured when investigations are restricted to individual targets.

4.3.1. Limitations and future directions

A limitation of the current study is that our sample was primarily composed of White participants. There is evidence that attitudes toward interracial romance can vary by participant race (Lalonde, Giguere, Fontaine, & Smith, 2007; Yancey, 2009), thus it is unclear to what extent these findings would generalize to samples of African Americans or members of other racial minority groups. Although restricting our analyses to only White participants did not influence results in the current studies, additional research is needed to confirm that these findings do not vary across racial groups. The current study was also constrained to interracial romance between Blacks and Whites, thus it is unclear whether these findings would apply to reactions to interracial romance between Whites and other racial minority group members or relationships between members of different racial minority groups (e.g., a Black person and an Asian person). In the future more nuanced investigations should be conducted to determine the influence and interactions between variations in participant group and target romantic relationship. Another limitation of our sample was that it consisted of young college students, who tend to be considerably more accepting of interracial romance than older Americans (Pew Research Center, 2010).

It is also important to note that this series of studies was limited to heterosexual couples. Thus, additional research is needed to determine whether our findings can be generalized to gay and lesbian couples. Given evidence that disgust is associated with disapproval of gay people (e.g., Inbar et al., 2009; Terrizzi et al., 2010), it is possible that the racial composition of gay couples has little added impact. Alternatively, there may be a cumulative effect such that couples that are gay and interracial may elicit even more disgust than couples that are just gay (same-race) or just interracial (heterosexual). It is also conceivable that racial composition may have different effects on lesbian couples relative to gay male couples. Future studies should examine the effects of these intersecting identities.

5. Conclusions

The current research expands upon the sparse existing literature on the attitudes and emotions underlying bias against interracial romance and challenges the notion that bias against interracial relationships is largely a thing of the past. Overall, the current research provides evidence that bias against interracial romance is associated with disgust, that interracial couples actually elicit a disgust response among observers, and that these feelings of disgust translate into dehumanization of interracial couples. The current findings provide evidence that interracial couples are implicitly dehumanized, such that they are less readily associated with the category "human" than same-race couples (and more readily associated with the category "animal"). These findings are meaningful given the negative consequences associated with dehumanization, most notably, antisocial behaviors such as aggression and perpetration of violence (Haslam & Loughnan, 2014).

Appendix A. Appendix

Appendix B. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jesp.2016.05.008.

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