12-2017

Manipulating Entitativity Affects Implicit Behavioral and Neural Attentional Biases Toward Gay Couples

Cheryl L. Dickter
William & Mary, cldickter@wm.edu

Catherine A. Forestell
William & Mary, caforestell@wm.edu

Nicholas Gupta

JoEllen J. Blass

Recommended Citation

Dickter, Cheryl L.; Forestell, Catherine A.; Gupta, Nicholas; and Blass, JoEllen J., Manipulating Entitativity Affects Implicit Behavioral and Neural Attentional Biases Toward Gay Couples (2017). *Group Processes & Intergroup Relations*, 22(2), 271-287.
https://doi.org/10.1177/1368430217737

Group Processes & Intergroup Relations
G P I R

Article

Manipulating entitativity affects implicit behavioral and neural attentional biases towards gay couples

Toward (without the –s) is the preferred choice in American English.

Group Processes & Intergroup Relations
1–17

DOI: 10.1177/1368430217737856
journals.sagepub.com/home/gpi
SAGE

Cheryl L. Dickter,[1] Catherine A. Forestell,[1] Nicholas Gupta[1] and JoEllen J. Blass[1]

Abstract

This study investigated whether attentional bias towards homosexual couples differs as a function of the manipulation of perceived entitativity, the degree to which group members are perceived to share common values and pursue common goals. Across two experiments, heterosexual college students were randomly assigned to read statements that suggested that homosexual and heterosexual couples were either high or low in entitativity. Following this task, 199 participants completed a dot probe task in Experiment 1 and electroencephalogram (EEG) activity was recorded for 74 participants in Experiment 2 to measure the implicit attentional processing that resulted from viewing pictures of gay, lesbian, and straight couples. Results indicated that participants exposed to low entitativity statements directed less behavioral and neural attention towards gay relative to straight couples compared to those exposed to high entitativity statements. Given the apparent malleability of attentional biases, future research should strive to better understand the factors involved in reducing attentional bias, and by extension discriminatory behaviors towards minority groups.

Keywords

attentional bias, dot probe, EEG, entitativity, ERPs, homosexual

Paper received 19 December 2016; revised version accepted 27 September 2017.

Over the years, substantial empirical and theoretical attention has been devoted to the causes and consequences of automatic social categorization. Much of this research has focused on racial prejudice and stereotypes, while relatively less research has focused on sexual minorities. However, despite the improvement of general societal attitudes towards homosexuality (Steffens & Wagner, 2004), social stigma towards sexual minorities remains pervasive (Almeida, Johnson, Corliss, Molnar, & Azrael, 2009; Röndahl, 2011; U.S. Department of Health and Human Services – Health Resources and Services Administration,

[1]College of William and Mary, USA

Corresponding author:
Cheryl L. Dickter, Department of Psychological Sciences, College of William & Mary, Williamsburg, P.O. Box 8795, VA 23187, USA.
Email: cldickter@wm.edu

2011), leading to the experience of emotional distress and negative health consequences (Almeida et al., 2009; D'Augelli, 1992; Garnets, Herek, & Levy, 1990; Meyer, 2003). Therefore, more research is needed to understand the behavioral and neural constructs responsible for the implicit cognitive processes that result in prejudicial behaviors towards sexual minorities.

Although biased attention does not necessitate prejudicial attitudes, it may be associated with implicit prejudicial behaviors towards outgroups. As a result, important information about the processes involved in person perception can be revealed by examining the extent to which rapidly unfolding, early attention-related processes differ as a function of social categorization.

Through implicit behavioral tasks, such as the dot probe reaction time task, research has shown that some outgroup targets tend to elicit more early attention than ingroup targets (Brosch & van Bavel, 2012; Trawalter, Todd, Baird, & Richeson, 2008). Early attentional biases have been shown to predict differences in the speed of racial categorization between ingroup and outgroup members later in processing (Dickter & Bartholow, 2007).

In addition to behavioral measures, psychophysiological measures can also be used to measure biased implicit attention. Event-related brain potentials (ERPs) are ideal for the study of implicit attentional processing because they have excellent temporal resolution, they are not under the participants' control, and they allow for the examination of implicit attention as early as 150 ms after the presentation of a target face. The amplitude of the P2, N2, and P3, the primary ERP components of interest in studying implicit attention, represents the extent to which a participant is attending to a stimulus. In work that has focused on biased attention to racial groups, the P2 component peaks at 180 ms poststimulus and is consistently larger to racial outgroups compared to ingroups (e.g., Dickter & Bartholow, 2007; Ito & Urland, 2003, 2005). The perceivers' attention then shifts as reflected by the increased amplitude to ingroup faces in the N2 ERP component, which typically peaks between 250 and 350 ms (Dickter & Bartholow, 2007, 2010) and is seen on the anterior scalp, consistent with medial prefrontal cortex activation (see Ito & Bartholow, 2009). The P3 component at 300–800 ms poststimulus demonstrates another attentional shift with greater focus on outgroup relative to ingroup faces (e.g., Dickter & Bartholow, 2007). Consistent with these findings, recent psychophysiological findings demonstrate that gay couples elicit stronger neural attentional responses than straight couples as measured by the P2 ERP component (Dickter, Forestell, & Mulder, 2015).

In combination, behavioral and physiological research suggests that there are a number of mechanisms that can affect implicit attentional biases to outgroups such as gay and lesbian couples. For example, the degree to which outgroups are perceived as threatening (Donders, Correll, & Wittenbrink, 2008; Koster, Crombez, Verschuere, & De Houwer, 2004; Salemink, van den Hout, & Kindt, 2007; Trawalter et al., 2008) or familiar (Dickter, Gagnon, Gyurovski, & Brewington, 2015) appears to affect the strength of attentional biases. Another variable that may be important is the degree to which members of a group are perceived as cohesive or viewed as an entity. This concept, referred to as "entitativity," was first defined by Campbell (1958) in an effort to understand the psychological factors involved in group perception. One's perception of a group is thought to stem from a belief that group members' behaviors and characteristics arise from common sources (as reviewed in Brewer, Hong, & Li, 2004). Common sources can include common history (past experiences, cultural socialization, or ancestry) or common attributes (innate internal dispositions such as genetic characteristics). By this criterion, groups may be perceived as units based on the extent to which they share common and immutable characteristics and experiences (Yzerbyt, Rocher, & Schadron, 1997) or because their members face a common problem, have a common purpose, and act in a coordinated way to achieve shared goals (Hamilton, Sherman, & Lickel, 1998). Although some have made the assumption that entitativity is merely based on physical similarity (Dasgupta, Banaji, & Abelson, 1999), research suggests that

entitativity captures group features beyond those of physical and behavioral similarity and is more closely associated with common motives and goals (Lickel et al., 2000; Pickett & Perrott, 2004; Welbourne, 1999).

Research has shown that outgroups are perceived to be more entitative than ingroups (Crump, Hamilton, Sherman, Lickel, & Thakkar, 2010; Haslam, Rothschild, & Ernst, 2002). The more entitative a group is considered to be, the more likely perceivers will generalize across group members, thereby increasing their reliance on stereotypes (Crawford, Sherman, & Hamilton, 2002; Spencer-Rodgers, Hamilton, & Sherman, 2007). Moreover, Ommundsen, Yakushko, van der Veer, and Ulleberg (2013) have found that individuals' fear-related xenophobia was strongly predicted by entitativity. Because fear and threat are associated with outgroup attentional bias, it seems reasonable to predict that shifting perceptions of entitativity may be one way to change outgroup bias.

The goal of the present work was to investigate whether manipulating perceived entitativity of homosexual couples would affect implicit attentional responses to gay male and lesbian couples. Across two studies, we exposed heterosexual participants to a set of either high or low entitativity statements that varied in the degree to which they described homosexual couples' reliance on one another and pursuit of a common goal; defining features of entitativity. In Experiment 1, we compared the groups' implicit attentional behavioral responses to gay male and lesbian couples relative to straight couples using a dot probe paradigm, ~~whereas~~ in Experiment 2, we measured psychophysiological attentional processing to gay male, lesbian, and straight couples. For both experiments, the dependent variable of interest was the difference between participants' processing of heterosexual and homosexual targets. A secondary goal of the present paper was to determine whether, as reported in our previous papers (Cunningham, Forestell, & Dickter, 2013; Dickter, Forestell, et al., 2015), implicit attentional bias was associated with explicit measures of attitudes towards gay males and lesbians, and the number of homosexual friends participants reported having.

We hypothesized that through manipulating perceptions of the entitativity of homosexual couples, participants' reliance on stereotypes would be shifted which would in turn shift their implicit attentional processing of outgroup (i.e., homosexual) compared to ingroup (i.e., ~~straight~~) couples. Specifically we predicted that participants in the high entitativity condition, who were exposed to statements that increased their perceptions of homosexuals' cohesiveness, may feel more threatened, which in turn may increase their implicit bias towards this group. Alternatively, those in the low entitativity group would learn that homosexual couples are not a cohesive group and thus may feel less threatened and be less likely to generalize across group members, which would decrease their implicit bias. Consistent with our previous findings (Cunningham et al., 2013; Dickter, Forestell, et al., 2015), we also predicted that we would find a positive association between implicit attentional bias and explicit attitudes towards gays and lesbians, and a negative association between implicit attentional bias and the number of gay and lesbian friends participants reported having.

Experiment 1

Method

Participants. A total of 199 participants (96 male, 103 female) between the ages of 18 and 22 years (M = 18.94 years, SD = 1.61) were recruited for this study. All participants were undergraduates at a medium-sized public liberal arts institution in ~~the~~ Virginia, and completed the study in partial fulfillment of their introductory psychology courses. All procedures were approved by the College of William and Mary Protection of Human Subjects Committee, and written informed consent was obtained from each participant.

Materials

Entitativity "fact sheets." A series of 24 statements were created to elicit entitative and non-entitative judgments about homosexual and

heterosexual couples. Entitative statements were designed to portray goals and behavior of the group and were presented as a statistic with either a high or low percentage (e.g., "29% [or 71%] of homosexual couples are motivated to have and raise children"; "85% [or 15%] of homosexual couples advocate for gay marriage law"), whereas nonentitative statements did not portray goal-directed behavior (e.g., "65% of heterosexual couples drink coffee"). All statements described banal characteristics or behaviors such as recreational activities, daily habits, political viewpoints, and living arrangements.

To test the believability of these statements, 200 participants were recruited for an online pilot test. Using Amazon's Mechanical Turk, statements were tested for believability using a 5-point Likert-type scale (1 = *definitely false*, 5 = *definitely true*). Following testing, statements with averages lower than 3.5 out of 5 were removed. This resulted in 10 entitative and seven nonentitative statements, which were used to create the entitativity fact sheets. Both fact sheets included five entitative statements about homosexual couples, five entitative statements about heterosexual couples, and five nonentitative statements (see Appendix). The rationale for using these seven statements was to disguise the extreme statistics of the entitativity statements. For each fact sheet, we manipulated the perceived entitativity of both homosexuals and heterosexuals. We considered this manipulation to be a more conservative test of our hypotheses; that is, we did not want to make salient a contrast effect between homosexual and heterosexual entitativity as it might exaggerate participants' perceptions of homosexual couples, which could have led to stronger effects of the manipulation.

For the high entitativity fact sheet, the entitative statements were presented with statistics that fell between 70% and 90%, whereas for the low entitativity fact sheet, percentages for each of the statements fell between 10% and 30%. Analyses revealed that these high and low entitativity statements about homosexual or heterosexual couples did not differ in believability (*p* values > .4). The percentages for the seven nonentitative statements ranged from 35% to 65% with an overall mean of 50% (e.g., "37% of straight couples use a satellite dish to view television at home").

Picture stimuli of couples. Fourteen sets of corresponding gay, lesbian, and heterosexual images (Cunningham et al., 2013) were presented to participants. These images were carefully selected to be matched in facial expression, physical appearance, pose, and emotionality. The images depicted only faces and upper torsos. Each set of pictures depicted two individuals involved in intimate displays of affection (see Figure 1) such as kissing (n = 5), close contact with faces touching or close to one another (n = 4), and close embraces (n = 5). The people in the pictures were White to ensure that differences in responses between pictures were due to differences in sexual orientation rather than race. Individuals in the pictures had no discernible unusual features (e.g., unconventional hairstyles or piercings) and differences in image color and brightness were controlled through the use of black and white images.

Dot probe task. In this behavioral task, two blocks of 40 trials were presented to each participant. Each trial began with a fixation cross in the center of the screen between 1,000 and 3,000 ms to ensure that reaction times were not affected by expectation of stimulus presentation. The pairs of stimuli—images of gay, straight, or lesbian couples—were then presented simultaneously on either side of the fixation cross. Combinations of stimuli (gay–straight and lesbian–straight) were presented with equal likelihood in a randomized order. The picture stimuli were presented for 100 ms followed by a visual mask presented for 433 ms. A black dot then appeared on the screen where one of the pictures had been, and remained there until the participant pressed a key denoting which side (left or right) the dot had appeared on the screen. This task was programmed with E-Prime 2.0 and presented with Dell UltraSharp U2211H wides-

Figure 1. Sample pictures of gay, lesbian, and straight stimuli.

creen LCD monitors that were 21.5" in size and ran a Full HD 1920 x 1080 resolution at 60 Hz.

All images of couples were equally likely to be presented on either the left or right side of the screen across trials. The reaction time to the button press signified a measure of relative attention to one type of couple over another, such that faster responses to the dot are made when participants are attending to the stimulus on the side of the dot. This task is especially useful as an implicit measure of attentional bias because participants are not explicitly engaging in preferential social categorization.

Questionnaires. In addition to completing a demographic questionnaire in which participants indicated their gender, age, race, and sexual orientation (i.e., heterosexual, homosexual, bisexual, other), the following questionnaires were administered to assess explicit attitudes towards homosexuality and familiarity with sexual minorities (i.e., gays, lesbians).

Familiarity with sexual minorities. In order to assess the number of close relationships participants had with sexual minorities, they were asked to indicate the percentage of their close friends who identify openly as a sexual minority (LGBT) on a sliding scale from 0% to 100%.

Attitudes Towards Lesbians and Gay Men Scale (ATLG). The full form of the ATLG (Herek, 1998) was used to assess attitudes towards homosexual individuals. This scale consists of 20 items, with half assessing attitudes towards gay men (ATG) and half assessing attitudes towards lesbian women (ATL). Participants reported the degree to which they agreed with statements such as "Homosexual behavior between two men is just wrong" and "Lesbians just can't fit into our society" using a 7-point scale (1 = *strongly disagree*, 7 = *strongly agree*). This scale has been shown to have strong internal consistency (α = .97). For the current study, responses were reverse-coded where necessary and summed to create subscale scores for the ATG (α = .94) and the ATL (α = .91), with higher scores indicating more negative attitudes towards each group.

Procedure. Participants completed the study in groups of two to four participants in a computer lab with privacy screens separating the work stations. Before the participants arrived, they were randomly assigned to the high or to the low entitativity condition. After completing the informed consent, participants were instructed to study the entitativity fact sheet for 5 minutes. Then, they completed either the affective misattribution

Table 1. Participant characteristics for Experiment 1 as a function of their entitativity condition.

Characteristic	High ent. (n = 76)	Low ent. (n = 80)	Test statistic
Age (years)	19.03 ± 1.68	18.89 ± 1.76	$t(154) = 0.49, p = .63$
Gender (% female)	49%	59%	$\chi^2(1) = 1.59, p = .21$
Race (% Caucasian)	54%	62%	$\chi^2(4) = 0.87, p = .93$
ATG	17.92 ± 9.17	17.41 ± 8.45	$t(154) = 0.36, p = .72$
ATL	16.63 ± 7.81	16.18 ± 7.01	$t(154) = 0.39, p = .70$
LGBT friends (%)	9.68 ± 10.35	8.39 ± 11.68	$t(154) = 0.68, p = .50$

Note. Continuous variables are reported as Means ± *SD*. ATG = attitudes towards gay men, ATL = attitudes towards lesbian women.

procedure (Payne, Cheng, Govorun, & Stewart, 2005; the results of which are described in the material to this manuscript) ction time task, the order of balanced. Participants then studied the fact sheet again while the second task was set up. Finally, the participants completed the questionnaires. When finished, they were debriefed, given credit for their participation, and dismissed. All participants completed the study within an hour.

We have not had a chance to see the online supplement.

Data analyses. Only reaction times (RTs) where participants accurately identified the location of the dot as presented on the screen in the dot probe were used for analyses. Participants who did not follow instructions (n = 1), for whom there were missing data (n = 3), or whose mean RT was greater than 3 *SD*s from the mean (n = 4) were excluded from analyses. To examine the relative attention to homosexual images compared to heterosexual images, a difference score was calculated in which RTs to trials in which the dot probe appeared on the side of the homosexual picture were subtracted from the reaction times to trials in which the dot probe appeared on the side of the heterosexual picture. As a result, positive difference scores indicated greater attention to the homosexual couple pictures relative to the heterosexual couple pictures.

To test the hypothesis that implicit attentional bias towards the homosexual versus heterosexual couples varied as a function of the entitativity manipulation, two univariate analyses of variance (ANOVAs) with entitativity (low, high) as the independent variable were conducted separately for the difference scores for gay male versus straight couples and lesbian versus straight couples. Additional analyses included raw RTs rather than difference scores. That is, separate 2 (dot condition: dot following homosexual trials vs. dot following heterosexual trials) x 2 (entitativity: high vs. low) mixed-model ANOVAs were conducted for trials containing gay and straight couples and trials containing lesbian and straight couples. To extend previous work that examined predictors of attentional bias (e.g., Dickter, Forestell, et al., 2015), correlational analyses were conducted in addition to the dot probe analyses to explore relationships between attentional bias and explicit measures.

Results

Participant Characteristics

Data were excluded for participants who did not follow instructions (n = 14). Participants who reported that they were not heterosexual (n = 16) were also excluded from the analysis. In addition, five participants were missing dot probe data. The remaining participants were approximately 19 years old (M = 18.96 years, SD = 1.72) and 84 were female. The majority of participants were White (n = 90), with 23 Asian, 19 Black, 13 Latino, and 11 "other." As shown in Table 1, those in the high entitativity condition (n = 76) did not differ from those in the low entitativity condition (n = 80) in gender, age, race, LGBT contact, or ATG/ATL subscales. Further exploratory analyses revealed

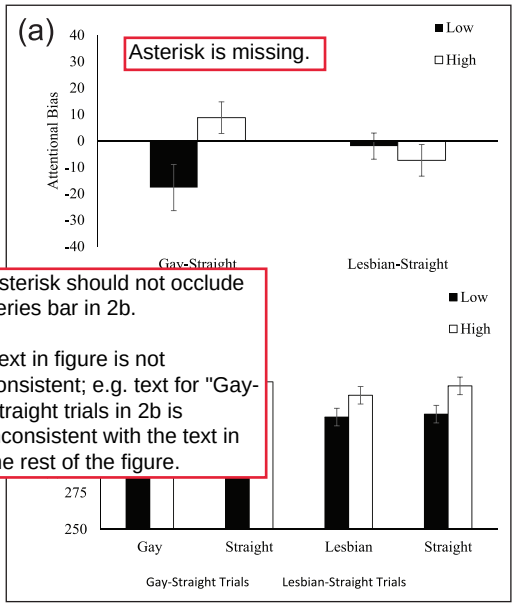

Figure 2. Attentional bias towards gay and lesbian couples compared to straight couples (a) and reaction time in the dot probe task to gay, lesbian, and straight couples (labels along the x-axis refer to the picture replaced by the dot for gay–straight and lesbian–straight picture pairs) (b) as a function of the entitativity manipulation in Experiment 1. The asterisk depicts a significant difference at $p < .05$ between the high and low entitativity conditions for gay couples.

that there were no significant effects of participant gender on the primary dependent variables. Therefore, this variable was not included in the analyses reported in what follows.

Dot Probe

As depicted in Figure 2a, analyses of difference scores revealed that participants in the low entitativity condition had less of an attentional bias ($M = -17.68$, $SE = 8.75$) towards gay relative to straight couples than those in the high entitativity condition ($M = 8.77$, $SE = 8.98$), $F(1, 154) = 4.45$, $p = .036$, $\eta_p^2 = .03$. For the lesbian versus straight couples, participants in the low entitativity condition ($M = -2.00$, $SE = 4.94$) did not differ from those in the high entitativity condition ($M = -7.38$, $SE = 5.07$), $F(1, 154) = 0.46$, $p = .46$, $\eta_p^2 < .01$.

When raw RTs rather than difference scores were used, the effect for gay versus straight couples mirrored the results with the difference scores; the interaction between dot condition and entitativity was significant, $F(1, 154) = 4.45$, $p = .036$, $\eta_p^2 = .03$. As depicted in Figure 2b, participants in the low entitativity condition had faster RTs than those in the high entitativity condition when the dot replaced the picture of gay couples, $F(1, 154) = 4.21$, $p = .042$, $\eta_p^2 = .03$. There was no difference for trials when the dot replaced the straight couple picture, $F(1, 154) = 0.00$, $p = .958$, $\eta_p^2 < .01$. The interaction between dot condition and entitativity for lesbian–straight trials was not significant, $F(1, 154) = 0.56$, $p = .457$, $\eta_p^2 < .01$.

Relationships Among Variables

Results of the correlational analyses indicated that those who reported having a higher percentage of gay and lesbian friends had marginally less attentional bias towards gay couples, $r = -.16$, $p < .070$. In addition, those with higher explicit prejudice, as indexed by ATG scores, had greater attentional bias towards gay couples, $r = .22$, $p = .006$. The relationship between ATL scores and attentional bias towards lesbian couples was not significant, $r = .08$, $p = .314$.

Discussion

The current study is the first to show that reading a series of only 17 statements, 10 of which contained entitative statements about homosexual and heterosexual couples, changes participants' implicit attentional processing of gay targets. Consistent with our hypotheses, we found that those exposed to low entitativity statements exhibited less attentional bias towards gay relative to straight couples compared to those exposed to high entitativity statements. The entitativity manipulation did not affect processing of lesbian compared to straight couples, which is consistent with our previous work showing that neural attention to lesbian couples does not differ from that of straight couples (Dickter, Forestell, et al., 2015).

In addition, we found a marginal correlation between gay–straight attentional bias and the self-reported percentage of sexual minority close friends. Although this was marginally significant, this trend is consistent with previous behavioral work on race (Dickter, Gagnon, et al., 2015) and psychophysiological work on sexual orientation (Dickter, Forestell, et al., 2015) that demonstrated that the greater number of close outgroup friends participants have, the smaller the bias between outgroup and ingroup targets. This study also revealed a significant correlation between attentional bias towards gay targets and explicit bias towards gay males, extending previous findings that reported a relationship between ATG and performance on a task designed to assess implicit levels of discomfort towards homosexual targets (Cunningham et al., 2013). It is important to note however, that the explicit bias towards gay and lesbian individuals was not affected by the entitativity manipulation.

Together these findings suggest that individuals who have more explicit bias and fewer sexual minority friends demonstrate more attentional bias towards gay couples. However, this bias appears to be plastic; our findings suggest that providing information that describes the goals and behavior of homosexual and heterosexual couples, which has been shown to change people's perceptions of group entitativity, affects attentional responses towards homosexual and heterosexual couples. The goal of Experiment 2 was to determine if these behavioral results could be replicated using ERPs as a measure of neural attentional bias.

Compared to behavioral approaches, ERPs not only provide a more temporally sensitive measure of attentional bias, but they also measure responses that are not under participants' control. One task that is often used while measuring ERPs is the oddball paradigm (Sutton, Braren, Zubin, & John, 1965). During this task, the participant is presented with a sequence of frequent nontarget stimuli interspersed with infrequent (oddball) target stimuli. The detection of the target stimulus is thought to reflect the focusing of attention on biologically important stimuli (Halgren & Marinkovic, 1995). With the oddball task, a larger P2 is associated with the processing of a stimulus that contains relevant features such as the oddball stimulus whereas the N2 reflects the cognitive control it takes to respond to the oddball stimulus but inhibit responses to the nontarget stimuli (Folstein & van Petten, 2007; García-Larrea, Lukaszewicz, & Mauguière, 1992; Halgren & Marinkovic, 1995). The P3 component is thought to reflect the processes involved in stimulus categorization when the oddball and nontarget stimuli need to be sorted and held in working memory (Donchin & Coles, 1988).

Based on our findings in Experiment 1, we hypothesized that participants who had been exposed to high entitativity statements about heterosexual and homosexual couples would show more attentional bias than those exposed to low entitativity statements. In this experiment, we predicted that shifts in attentional bias would be demonstrated through enhanced P2, consistent with our previous study that reported that this component was differentially responsive when participants viewed pictures of gay and straight couples.

Experiment 2

Method

Participants. Participants were 74 undergraduates (36 male) between the ages of 17 and 22 years (M = 19.10 years, SD = 1.10) at a medium-size public liberal arts university in Virginia who participated for partial fulfillment of a course requirement. All participants were right-handed and none had a history of major head injury. All procedures were approved by the College of William and Mary Protection of Human Subjects Committee, and written informed consent was obtained from each participant.

Materials. The entitativity "fact sheets" used in the current study were identical to those in Study 1, as were the picture stimuli used in the EEG task. As in Study 1, the perceived entitativity of both homosexuals and heterosexuals was manipulated.

EEG task. In the current study, participants viewed 222 trials that were mostly heterosexual couples (174 pictures) interspersed with 48 (oddball) pictures of homosexual couples. Participants were instructed to press a key with their right hand as fast as they could when an oddball image appeared on the screen. Each image was presented on the screen for 1,000 ms and participants had 1,800 ms to respond. After the picture was removed, a blank screen appeared for an intertrial interval of 500 ms before the next image was presented. ERPs were time-locked to the presentation of the pictures of homosexual couples.

Questionnaires. Participants completed the same demographics and familiarity measure as in Study 1. In this experiment, participants completed the short version of the ATLG (Herek, 1998), which has 10 items per subscale. For the current experiment, the subscale scores for the ATG (α = .93) and the ATL (α = .94) yielded acceptable reliability.

Procedure

Upon arriving to the laboratory, participants completed a consent form and were seated in an electrically shielded Faraday chamber approximately 70 cm from a computer monitor. Participants were asked to be as still as possible during the experiment in order to reduce the amount of extraneous noise in the EEG recordings. Participants were given the entitativity fact sheet for 5 min. They completed the task while EEG was recorded continuously. Finally, participants completed the questionnaires. When finished, they were debriefed, given credit for their participation, and dismissed. All participants completed the study within 1.5 hr.

Electrophysiological Recording and Analysis

EEG data were recorded using a DBPA-1 Sensorium Bioamplifier (Sensorium Inc., Charlotte, VT) with an analog high-pass filter of 0.01 Hz and a low-pass filter of 500 Hz (four-pole Bessel). The EEG was recorded from 74 Ag-AgCl sintered electrodes in an electrode cape, placed using the expanded international 10–20 electrode placement system. All electrodes were referenced to the tip of the nose and the ground electrode was placed in the middle of the forehead, slightly above the eyebrows. Eye movement and blinking were recorded from bipolar electrodes placed on the lateral canthi and peri-occular electrodes on the superior and inferior orbits, aligned with the pupils. Before data collection was initiated, all impedances were adjusted to 0–20 kΩ. EEG was recorded continuously throughout the computer task and was analyzed offline using EMSE 5.3 software. Data were undersampled at 500 Hz. The data were corrected for eye movement artifacts, using independent component analysis (Jung et al., 2000). Individual trials with voltages outside a −200 to 200 μV range were excluded from analysis. All EEG data were filtered at low pass 20 Hz (Luck, 2005). The data were segmented between 200 ms prior to stimulus onset and 1,000 ms poststimulus onset. After baseline correction over the prestimulus interval, segmented data were averaged for each participant in each of the conditions.

Visual inspection of the grand average waveforms was used to quantify each ERP component. An electrode variable was included in a repeated-measures analysis of variance along with the conditions of interest. The electrodes that typically present the ERPs of interest in similar past research were examined, and the electrode yielding the highest amplitude for each component was chosen (Boutsen, Humphreys, Praamstra, & Warbrick, 2006; Huang & Luo, 2007; Maurage et al., 2012; Stefanics, Csukly, Komlósi, Czobor, & Czigler, 2012). The P2 component was quantified as the largest positive voltage between 150 and 250 ms at electrode Pz. The N2 component was quantified as the largest negative voltage between 150 and 360 ms at electrode Fz. Finally, the P3 component was quantified as the largest positive voltage between 250 and 400 ms at electrode Pz.

In order to examine whether neural attentional bias towards the homosexual versus heterosexual pictures differed as a function of

Table 2. Participant characteristics for Experiment 2 as a function of their entitativity condition.

Characteristic	High ent. (n = 33)	Low ent. (n = 30)	Test statistic
Age (years)	19.15 ± 1.06	18.94 ± 0.81	$t(61) = -0.39, p = .70$
Gender (% female)	67%	61%	$\chi^2(1) = 0.25, p = .62$
Race (% Caucasian)	50%	67%	$\chi^2(4) = 6.20, p = .19$
ATG	18.03 ± 9.85	14.64 ± 5.85	$t(61) = -1.68, p = .10$
ATL	17.33 ± 9.36	14.77 ± 5.42	$t(61) = -1.31, p = .20$
LGBT friends (%)	8.09 ± 10.14	13.03 ± 16.58	$t(61) = 1.19, p = .24$

Note. Continuous variables are reported as Means ± *SD*. ATG = attitudes towards lesbian women, ATL = attitudes towards lesbian women.

participants' condition, difference scores were calculated, as in Experiment 1. In the current experiment, the peak amplitudes to homosexual couples were subtracted from the peak amplitudes to heterosexual couples separately for gay and lesbian couples for each ERP component. These difference scores were subjected to separate univariate ANOVAs with entitativity (low vs. high) as the independent variable for the difference scores for gay male versus straight couples and lesbian versus straight couples. Additional analyses were conducted using raw ERP scores for gay, lesbian, and straight couples. To examine whether raw amplitude ERP scores to homosexual versus heterosexual couples differed as a function of condition, separate 2 (sexual orientation: homosexual vs. heterosexual) x 2 (entitativity: high, low) ANOVAs were conducted in which responses to gay and straight couples or lesbian and straight couples were compared. As in Experiment 1, additional correlational analyses were conducted, which explored the relationships among P2 amplitude and explicit measures of prejudice, in order to replicate and extend previous findings.

Results

Participant Characteristics

Of the 74 participants, five were excluded from analyses due to excessive EEG artifacts and six additional participants were excluded who indicated that they were not heterosexual. The remaining 63 participants (22 males) were between the ages of 18 and 21 years (M = 19.00 years, SE = 0.97), and 58.7% reported their race as White, 6.3% Black, 19.0% Asian, 6.3% Hispanic, and 9.5% other. There were 33 participants in the low entitativity condition and 30 in the high entitativity condition. As demonstrated in Table 2, these groups did not differ in age, gender, race, ATG, ATL, or the number of LGBT friends.

Psychophysiological Results

P2. Results indicated that there was a significant effect of condition on the gay–straight difference amplitude at electrode Pz, $F(1, 61) = 4.81$, $p = .032$, $\eta_p^2 = .07$, as demonstrated in Figure 3a. Participants in the low entitativity condition had significantly less bias ($M = -0.43$, $SE = 0.66$) than participants in the high entitativity condition ($M = 1.68$, $SE = 0.70$). No differences were found with the lesbian–straight difference scores. As shown in Figure 3b, when P2 amplitudes rather than difference scores were used to determine the effect of the entitativity manipulation on raw amplitudes, there was a Sexual Orientation x Condition interaction for gay couples compared to straight couples, $F(1, 61) = 4.81$, $p = .032$, $\eta_p^2 = .07$. As shown in the waveform depicted in Figure 4, simple main effects analyses revealed that participants in the high entitativity condition had larger P2 amplitudes than those in the low entitativity condition for gay couples, $F(1, 61) = 4.57$, $p = .036$, $\eta_p^2 = .07$; there was no difference between the groups for straight couples, $F(1,$

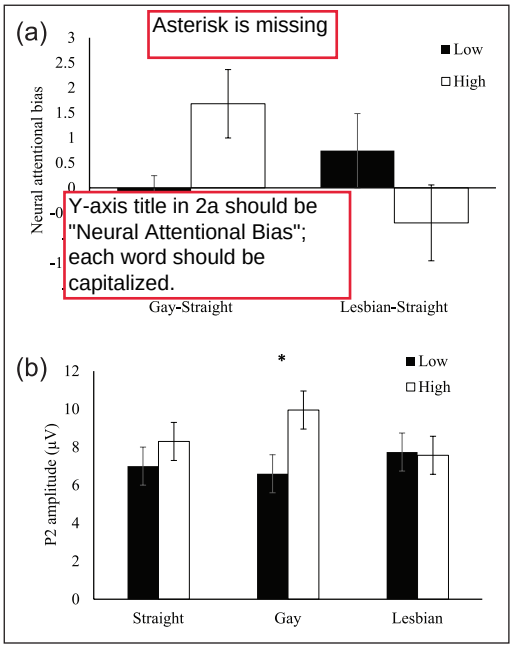

Figure 3. Neural attentional bias in the P2 ERP component to gay and lesbian couples compared to straight couples (a) and P2 amplitude for straight, gay, and lesbian couples (b) at electrode Pz as a function of the entitativity manipulation in Experiment 2. The asterisk depicts a significant difference at $p < .05$ between the high and low entitativity conditions for gay couples.

61) = 0.78, p = .382, η_p^2 = .01. The interaction for lesbian–straight trials was not significant, $F(1, 61) = 1.85$, p = .179, η_p^2 = .03.

N2. No significant effect of condition was found for either the gay–straight difference score or for the lesbian–straight difference score, ps > .25. The Sexual Orientation x Condition interaction for gay–straight trials using raw amplitudes was not significant, nor was the effect for lesbian–straight trials, ps > .25.

P3. No significant effect of condition was found for the gay–straight difference score or for the lesbian–straight difference score, ps > .70. When P3 amplitudes rather than difference scores were used to determine the effect of the entitativity manipulation on raw amplitudes, there were no

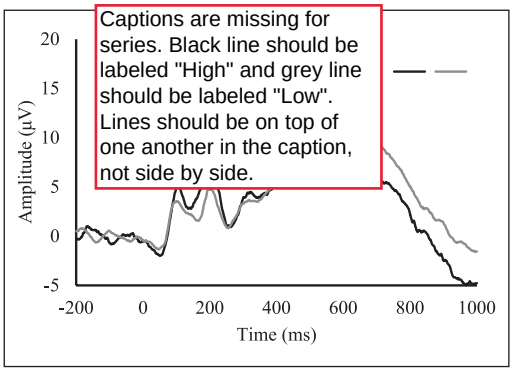

Figure 4. P2 amplitude at electrode Pz to gay couples as a function of the entitativity manipulation in Study 2.

significant interactions for gay couples or lesbian couples compared to straight couples, ps > .30.

Relationships Among Variables

After removing two participants whose scores were more than 3 *SD*s above the mean on the percentage of gay and lesbian friends participants reported (M > 39.99%), correlational analyses ~~indicated that the~~ higher the percentage of gay and lesbian friends that a participant had, the lower their P2 difference score between the gay and straight couples, ~~although this relationship was marginal~~, $r = -.24$, $p < .07$. In addition, the higher the explicit prejudice, as indexed by ATG scores, the more neural bias towards gay compared to straight targets, $r = .23$, $p < .08$~~, although this was marginally significant.~~ The correlation between ATL and amplitude to lesbian compared to straight targets was also marginally significant, $r = .24$, $p < .07$. There were no ~~other significant effects, nor were there~~ significant correlations for N2 or P3 ERP components.

Discussion

Experiment 2 assessed neural attentional bias towards gay, lesbian, and straight couples after an entitativity manipulation. Compared to exposure to high entitativity statements, exposure to low entitativity statements elicited less neural

attentional bias towards gay couples. In contrast, the entitativity manipulation did not affect the processing of lesbian compared to straight couples. Overall, these findings are consistent with previous work showing that relative to straight couples, larger P2 amplitude was observed in response to gay but not to lesbian couples (Dickter, Forestell, et al., 2015). It is not surprising that our analyses did not reveal that the N2 and P3 components differed as a function of our manipulation because P2 is the only component that has been shown to be associated with close outgroup friendships in previous studies on sexuality (Dickter, Forestell, et al., 2015) and race (Dickter & Bartholow, 2007). Additionally, this ERP component has been found to yield the most reliable differences in attentional processing between racial outgroup and ingroup members and to predict the speed at which participants categorized targets later in processing (Dickter & Bartholow, 2007).

Although the entitativity manipulation did not shift participants' attitudes towards gay men and lesbians, our results revealed marginally more neural attentional bias in individuals who reported higher explicit bias, suggesting a relationship between neural processing and explicit prejudice. We also found a marginal correlation between the gay–straight difference score for the P2 component and the number of close LGBT friends reported. This is different from our previous study in which we found a significant correlation between P2 lesbian–straight bias and number of LGBT close friends. These correlations between explicit measures and attentional bias may reflect weak associations that are only transiently detected.

General Discussion

Across two studies, we demonstrated that behavioral and neural attentional bias were affected by exposing participants to a series of 10 statements that manipulated the degree to which they perceived homosexual and heterosexual couples to be motivated by common goals and pursuits. Given that implicit attention is thought to reflect the automatic encoding and orienting of social categorization (Ito & Bartholow, 2009), the current findings have implications for prejudicial behavior. Attention to members of certain social categories has been shown to be associated with the degree of threat group members are thought to pose (Donders et al., 2008; Trawalter et al., 2008). Greater attention to group members, particularly those who engage in counterstereotypic behaviors, may affect the evaluations of individuals belonging to these groups (e.g., Bettencourt, Dill, Greathouse, Charlton, & Mulholland, 1997; Dickter & Gyurovski, 2012), which can have consequences for later behavior towards these individuals. Together with previous research, the current work suggests that providing people with information that changes their perceptions about the degree to which members of outgroups are pursuant of common goals may shift implicit attentional bias towards these groups, which may in turn affect discriminatory behavior.

One of the strengths of this study is that we investigated responses to gay male and lesbian couples separately by employing carefully selected pictures of lesbian and gay male couples. Most previous research has combined lesbian and gay male stimuli into a broad category of "homosexual," which fails to recognize important differences in perceptions of gay male and lesbian couples. While those in the low entitativity condition displayed less of an attentional bias towards gay male couples relative to straight couples than those in the high entitativity condition, there was no such difference in attentional bias for lesbian couples. This may have occurred because there was little initial attentional bias towards lesbian targets compared to straight targets, as was previously reported in Dickter, Forestell, et al. (2015). If we assume that the manipulation served to *decrease* attentional bias for those in the low entitativity condition, rather than *increase* attentional bias for those in the high entitativity condition, the lack of a difference in attentional bias towards gay relative to straight couples between conditions may have reflected a floor effect.

Of course, it is possible that rather than (or in addition to) decreasing attentional bias in the low

entitativity condition, attentional bias may have been increased in the high entitativity condition because reading statements about homosexual couples' similar goals led to a threat response. For some heterosexual participants, learning that homosexual couples are motivated to support LGBTQ businesses and have children could be threatening to their way of life, which could lead them to direct more attention to homosexual couples. Alternatively, the manipulation could have caused participants to compare their own behaviors to those of their ingroup. If they identified more with the heterosexuals in the low entitativity condition, they may have directed their attention towards heterosexual couples, thus yielding greater attentional bias towards the heterosexual couples compared to the homosexual couples.

In both experiments, our results revealed that larger attentional bias was found in individuals with higher ATG scores, consistent with previous work that has shown a relationship between implicit and explicit bias (Cunningham et al., 2013) for sexual minorities. These findings suggest that attentional bias may be associated with explicit prejudicial attitudes. This is consistent with work by Ito, Thompson, and Cacioppo (2004) who found greater amplitudes in the LPP component to racial outgroups compared to ingroups in participants who scored high on modern racism. However, not all research supports this contention. For example, Dickter, Gagnon, et al. (2015) failed to find significant relationships between implicit attention to racial outgroup targets and self-reported explicit bias. Due to these discrepancies, future work should continue to examine potential relationships between these variables.

Although not tested directly in this experiment, it is possible that shifts in perceptions of entitativity may change through close contact. We found that heterosexual individuals who have more explicit bias and fewer sexual minority friends tend to demonstrate more behavioral and neural attentional bias towards gay couples. According to Allport's conceptualization of contact theory (1954), positive encounters with outgroup members facilitate positive attitude changes towards these groups. In addition to positive attitudes, this study and other work have shown that close contact tends to be associated with less attentional bias (Dickter, Forestell, et al., 2015; Dickter, Gagnon, et al., 2015) and implicit prejudice (e.g., Dasgupta, McGhee, Greenwald, & Banaji, 2000; Shook & Fazio, 2008). Although little work has examined the mechanism involved in shifts of attentional bias and prejudice, there is some suggestion that associations between the evaluative valence of a recent encounter with a minority group and individuals' attitudes towards that group were partially mediated through perceptions of entitativity of the minority group (Ommundsen et al., 2013). Whether changes in perceptions of entitativity mediate the relationship between close contact with outgroup friends and attentional biases or prejudicial behavior towards outgroups is an important topic for future research.

Future work should address the limitations of the current study. Because the sample consisted of heterosexual university students, it is difficult to generalize the findings to the general population. Future research should recruit a more representative sample of heterosexual *and* homosexual participants. Additionally, given the short time frame between reading the entitativity statements and the assessment of attention, it was impossible to determine how long the statements affected participants' responses towards gay male couples. Future research should test participants' attention at various time points after reading the statements to determine how long this manipulation lasts. In the present study, the manipulation did not appear to affect participants' explicit attitudes towards homosexuals. It would be informative to also determine whether the manipulation affected the degree to which participants felt threatened by the homosexual couples to determine whether this is the mechanism through which the shift in attentional bias occurs. Finally, because this study manipulated the perceived entitativity of both homosexuals and heterosexuals, it was impossible to determine if our results were due to the manipulated entitativity of just one group or

both groups. We chose to manipulate the entitativity of both groups because we thought that the contrast effect created by manipulating only homosexual entitativity might exaggerate participants' perceptions of homosexual couples, which arguably could have led to bigger differences in biased attention between homosexual and heterosexual couples. To determine whether this is in fact the case, current studies in our lab are examining the effects of manipulating only homosexual entitativity.

The findings reported herein provide important implications for our understanding of entitativity and its relationship to attentional bias. Through changing heterosexual participants' perceptions of entitativity of sexual minorities, their attentional biases towards gay couples were shifted relative to those of straight couples. Whether this approach results in long-term changes in biases, prejudice, and discriminatory behavior remains to be investigated. We propose that reductions in perceptions of entitativity may be one mechanism through which close contact reduces prejudicial behavior.

Funding

This work was supported by a summer faculty research grant awarded to the first author by the College of William and Mary as well as an honors grant awarded to the third author by the College of William and Mary's Charles Center.

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Please italicize "High Entitative Condition" and start the sentence beginning with 86% on a new line.

Appendix

High Entitative Condition86% of *heterosexual* couples are motivated to have and raise multiple children.

70% of *homosexual* couples advocate for gay marriage law.

88% of *heterosexual* couples advoc
coverage for contraception.

47% of *heterosexual* couples work f

65% of *heterosexual* couples drink

80% of *homosexual* couples actively
ties to be part of the LGBT communit

Please remove the italics for the words homosexual and heterosexual throughout these statements (i.e., for both the statements in the high and low entitative conditions.

71% of *homosexual* couples are motivated to have and raise children.

40% of *heterosexual* couples recycle paper, plastic, and aluminum.

88% of *homosexual* couples are motivated to actively support businesses owned by other homosexual individuals in their community.

37% of *heterosexual* couples have a fire extinguisher in the house.

90% of *heterosexual* couples actively pursue friendships with homosexual couples.

60% of *heterosexual* couples set an alarm in the morning to wake up.

70% of *heterosexual* couples pursue active friendships with other heterosexual couples.

63% of *heterosexual* couples have a pet.

75% of *homosexual* couples actively pursue friendships with heterosexual couples.

37% of *heterosexual* couples use a satellite dish to view television at home.

77% of *heterosexual* couples are motivated to actively support small, local businesses in the community.

Low Entitative Condition

14% of *heterosexual* couples are motivated to have and raise multiple children.

30% of *homosexual* couples advocate for gay marriage law.

12% of *heterosexual* couples advocate for insurance coverage for contraception.

47% of *heterosexual* couples work full-time.

65% of *heterosexual* couples drink coffee.

20% of *homosexual* couples actively pursue opportunities to be part of the LGBT community.

29% of *homosexual* couples are motivated to have and raise children.

40% of *heterosexual* couples recycle paper, plastic, and aluminum.

12% of *homosexual* couples are motivated to actively support businesses owned by other homosexual individuals in their community.

37% of *heterosexual* couples have a fire extinguisher in the house.

10% of *heterosexual* couples actively pursue friendships with homosexual couples.

60% of *heterosexual* couples set an alarm in the morning to wake up.

30% of *heterosexual* couples pursue active friendships with other heterosexual couples.

63% of *heterosexual* couples have a pet.

25% of *homosexual* couples actively pursue friendships with heterosexual couples.

37% of *heterosexual* couples use a satellite dish to view television at home.

23% of *heterosexual* couples are motivated to actively support small, local businesses in the community.