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Reaction Formation and Homophobia: An ERP Examination

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Reaction Formation and Homophobia: An ERP Examination

by

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ABSTRACT

Homophobia in men may be, in part, due to reaction formation rooted in unacceptable same-sex attraction. Previous studies have not confirmed a covert same-sex attraction in homophobic men, which is necessary for a reaction formation theory of homophobia. This study sought to reveal possible covert same-sex attraction in homophobic men. In this study, heterosexual and homosexual male erotic images were presented in a passive S1/S2 stimulus prediction design to 48 self-identified heterosexual participants, grouped by homophobia. Three event-related potential responses related to valenced emotional processing were examined: the medial frontal negativity (MFN), the late positive potential (LPP), and the positive frontal slow wave (FSW). While homophobic men have a larger FSW in response to erotics across the board, $F(1,46) = 3.88$, $p = .055$, no significant interactions between homophobia and image content were found. As such, homophobic men may have more interest in erotic images in general, but this study does not demonstrate that homophobic men find homosexual erotics appetitive.

INTRODUCTION

Homophobic attitudes and behaviors have a profound negative impact on their targets. One study found that over a third of gay men experienced verbal harassment over a six-month period, and almost 5% had experienced physical violence (Huebner, Rebchook, & Kegeles, 2004). Homophobia has often been studied specifically in men, as men's attitudes toward gays and lesbians are more negative than those of women, with the most extreme negative attitudes held by straight men toward gay men (Goodman & Moradi, 2008; Herek, 1988). In addition, federal hate crime statistics show that anti-gay harassment and violence is primarily committed by men, and the most common targets for this violence are gay men (FBI, 2009, 2010). One possible root of this strong homophobia in men may be a reaction formation process, converting unacceptable same-sex attraction into its opposite (Adams, Wright, & Lohr, 1996; Weinstein et al., 2012). Reaction formation necessitates a covert same-sex attraction in homophobic men, which has so far eluded direct observation. This study seeks to examine potential covert same-sex attraction using valenced event-related potentials (ERPs), particularly the medial frontal negativity (MFN), which is thought to index whether an outcome is better or worse than expected (Nieuwenhuis, Holroyd, Mol, & Coles, 2004; Potts, Martin, Burton, & Montague, 2006).

Reaction formation and homophobia

While the negative impact of homophobia is not a new phenomenon, psychological study of homophobia has emerged only within the past 50 years. The word

homophobia was coined by George Weinberg in the late 1960s as part of a response to anti-gay prejudice within the field of psychology (Herek, 2004). At this time, homosexuality was widely regarded as disordered and treated as psychopathology. The APA removed homosexuality from the list of DSM disorders only two years after the publication of Weinberg's book *Society and the Healthy Homosexual* (Conger 1975). Homophobia was initially conceptualized by Weinberg (1972) as "the dread of being in close quarters with homosexuals". However, this dread does not appear to reach the criteria for a clinical phobia, despite the implications of the term. For example, Logan (1996) administered a simple phobia scale with a gay target, modified from the Revised Anxiety Disorders Interview Schedule, to a sample of 384 undergraduate students. Analysis of participant responses found no evidence of phobia. The term *homophobia* is instead used to describe personal discomfort caused by association with gay men and lesbians, as well as prejudicial attitudes about the appropriate extent of public behavior for gay men and lesbians (Herek, 1988; Hudson & Ricketts, 1980; Raja & Stokes, 1998).

The Modern Homophobia Scale for Gay Men (MHS-G, Raja & Stokes, 1998) and the Attitudes Toward Gay Men survey (ATG, Herek, 1988) are illustrative of how homophobia towards gay men is typically operationalized. Both surveys are composed of statements that are rated on Likert-type scales with options ranging from "strongly agree" to "strongly disagree". Items which assess prejudicial attitudes about public behavior for gay men include the ATG item 13, "Male homosexuals should not be allowed to teach school," as well as MHS-G item 17, "Gay men shouldn't be allowed to join the military," and MHS-G item 20, "Marriages between gay men should be legal". Each scale also has a number of items which measure personal discomfort with

association with gay men, including ATG item 17, "I would not be too upset if I learned that my son were a homosexual", MHS-G item 1, "I wouldn't mind going to a party that included gay men," and MHS-G item 6, "I don't think it would negatively affect our relationship if I learned that one of my close relatives was gay."

Some prefer not to use *homophobia* to refer to these personal and institutional prejudices, believing that the underlying construct is not an actual phobia. A common alternative interpretation is that the dominant emotional reaction underlying these attitudes is not fear or anxiety, but anger or hostility (Herek, 2004; Logan, 1996). This is supported by some evidence: for example, Hudepohl, Parrott, and Zeichner (2010) found that homophobic men experienced increased anger after viewing depictions of romantic and sexual intimacy between two men. Parrott and Peterson (2008) administered a structured interview to heterosexual men, including an assessment of homophobic attitudes, history of anti-gay aggression, and anger in response to a vignette depicting a gay male couple's public display of affection (PDA) and found that anger caused by gay male PDA mediated the relationship between homophobia and self-reported anti-gay aggression. However, these studies examined anger in isolation, and did not consider the role of other affective responses. Parrott, Zeichner, and Hoover (2006) examined changes in both anxiety and anger in heterosexual men caused by watching erotic videos of homosexual male couples. This was followed by a lexical decision-making task in which participants categorized emotional and non-emotional words; participant response time to anger-related words in this task was used as an indicator of anger network activation. They found an increase in anger after watching an erotic video featuring a homosexual male couple, which was positively correlated with sexual prejudice. This correlation was

mediated by participant response on anxiety-related negative affect items, but not anger-related items. This suggests that homophobic anger may in fact stem from anxiety. This finding is bolstered by studies in which heterosexual men's masculinity is threatened. Glick, Gangl, Gibb, Klumpner, and Weinberg (2007) found heterosexual men reported increased fear and discomfort, in addition to hostility towards effeminate homosexual men. Moreover, Talley and Bettencourt (2008) found that heterosexual men displayed increased aggression towards gay men in a competitive reaction time task as measured by the amount of punishment allotted to ostensible gay male targets.

Other evidence indicates that homophobia-related anxiety in men is a result of internalized gender role norms. Research into beliefs about gender and sexuality has shown that people believe and act as though "male" and "female" are in opposition, and that homosexuality is perceived to make a person more like the opposite gender (Kite & Deaux, 1987). As such, men's socialization regarding gender and sexuality strongly discourages same-sex attraction, or performing behaviors which may suggest same-sex attraction to observers (Fassinger, 2000). It is thus unsurprising that adherence to traditional gender roles is positively correlated with homophobia (Goodman & Moradi, 2008; Herek, 1988).

The following set of studies performed by Bosson and colleagues illustrates the relationship between heterosexual men's adherence to traditional gender roles and homophobic discomfort. In one study by Bosson, Taylor, and Prewitt-Freilino (2006), heterosexual men and women were instructed to imagine performing an act which violates gender norms, then asked to rate their prospective comfort in performing this act and the likelihood that an observer would believe them to be gay. The results showed

that men were less comfortable with the idea of publicly violating gender roles, and the relationship between participant gender and discomfort was mediated by the expectation of being classified as gay by observers. Another study found that heterosexual men's discomfort with gender role violations can be lessened if they can inform the audience of their heterosexuality (Bosson, 2005). Men asked to perform a female stereotypic hairstyling task reported less discomfort when their heterosexual orientation was displayed than when it was not, presumably because of greater concern about the possibility of being classified as gay.

This gendered distress about being classified into a stigmatized group impacts sexual identity development in men (Fassinger, 2000). This is evident in one model of heterosexual identity development proposed by Worthington, Savoy, Dillon, & Vernaglia (2002), which includes "homonegativity, sexual prejudice, and privilege" as contributing factors. One possible way that homophobic gender norms impact heterosexual identity formation is a process akin to Freudian reaction formation, where desires unacceptable to the self are converted into their opposite. Among men who adhere to traditional gender norms homophobia may be a reaction to their unacceptable experience of same-sex attraction. At least one study supports the idea that homophobic straight-identified men find depictions of homosexual acts to be appetitive. Adams, Wright, and Lohr (1996) found that among straight-identified men, only those high in homophobia had a significant erectile response while viewing erotic videos featuring homosexual men. While this implies sexual arousal on the part of participants, the authors acknowledged that this result may have been driven by negative affect, particularly anger or frustration. However, anger actually appears to reduce tumescence and inhibit sexual arousal while

anxiety does not (Bozman & Beck, 1991). This casts doubt that anger could mediate the erectile response measured by Adams et al, but it is consistent with previously described research which posits a central role of anxiety in homophobia. While these results are consistent with homophobia's roots in reaction formation, this finding is not conclusive due to the ambiguity in interpreting the physiological results.

More compellingly, a recent study indicated that homophobic attitudes are correlated with incongruity between self-reported sexual orientation and sexual orientation as measured by an implicit association task (IAT, Weinstein et al., 2012). The IAT in this study involved categorizing words and pictures into categories ("gay" and "straight") following a masked prime ("me" or "others"); reaction time for me-straight pairings were compared to me-gay pairings to determine implicit sexual orientation. The relationship between homophobia and incongruity between measures of sexual orientation was mediated by self-reported parental autonomy support and parental homophobia, suggesting that discrepancies between explicit and implicit sexual orientation develop when same-sex attraction in the self is perceived to be unacceptable. However, the discrepancies found here are between explicit and implicit measures of participant identification with the categories "gay" or "straight", and do not include direct or indirect assessment of the participants' attraction to the same sex. In addition, both self-focus and anxiety facilitate response reaction time in simple categorization tasks (Panayiotou & Vrana, 2004). The IAT used in this study, which was designed to measure association between the self and homosexuality, necessarily involves self-focus; association between the self and homosexuality is also likely to cause anxiety in homophobic men, as described in detail above. While implicit participant identification

with homosexuality is highly consistent with a reaction formation hypothesis, this study has a number of limitations and does not conclusively demonstrate the central suggestion of reaction formation: that homosexual stimuli are appetitive to homophobic straight-identified men. Such an appetitive reaction would presumably involve a reward-related or approach-related neural response during perception of homosexual erotic stimuli. If this sort of neural response pattern were observed in homophobic straight-identified men, particularly in the presence of self-reported aversion to homosexual erotic stimuli, this would conclusively demonstrate reaction formation in these men.

ERPs and affective evaluation.

Neural processes, including those underlying an appetitive response to stimuli, may be investigated in a noninvasive way using either event-related potentials (ERPs) or functional magnetic resonance imaging (fMRI). Olofsson, Nordin, Sequeira, and Polich (2008) systematically compared the usefulness of these two methods during affective responses, concluding that ERP methods are preferable for investigating rapid affective evaluation, while fMRI is recommended for sustained processes during extended stimulus presentation. As valenced affective evaluations are rapid, and occur even after very brief stimulus presentation (Schupp, 2004), ERP methods are best suited for an examination of these responses.

The medial frontal negativity (MFN) is one ERP component which can be used to differentiate between appetitive and aversive responses to stimuli. The MFN is a sharp negative deflection over medial frontal electrodes which peaks 250-450 milliseconds after the onset of a stimulus, first characterized by Miltner, Braun, and Coles (1997) as a response to negative feedback in a time-estimation task. They localized the source of the

MFN to the anterior cingulate cortex (ACC), which receives input from mesolimbic dopaminergic neurons. In addition to negative feedback in time-estimation tasks, the MFN is also reliably elicited in response to feedback indicating monetary losses during a variety of forced-choice gambling tasks in which participants win or lose a small amount of money by choosing among doors, cards, or balloons (Dunning & Hajcak, 2007; Gehring & Willoughby, 2002; Itagaki & Katayama, 2007; Yeung & Sanfey, 2004; Yu & Zhou, 2006). One example of this is the paradigm used by Dunning and Hajcak (2007), in which participants chose between two doors presented on a computer screen. Following this choice, a colored arrow was presented as feedback: a green arrow pointing up indicated a $0.20 gain, and a red arrow pointing down indicated a $0.10 loss. An MFN was seen following feedback which indicated a loss, but not feedback indicating a gain.

The MFN is also elicited by pre-stimulus cues that predict a monetary loss in paradigms where reliable predictive stimuli are provided (Dunning & Hajcak, 2007; Yu & Zhou, 2006). In Dunning and Hajcak's study, these predictive stimuli indicated whether 0, 1, or 2 of the subsequently presented doors concealed a monetary gain, which resulted in positive feedback on 0%, 50%, and 100% of the indicated trials, respectively. In this study, loss cues (0 doors) resulted in a small but significant negativity compared to gain cues (2 doors). Further study has demonstrated that the MFN is also context-dependent. In gambling paradigms, the MFN is not only observed in response to monetary losses, but also failure to achieve an expected monetary gain (Holroyd, Larsen, & Cohen, 2004; Potts et al., 2006). In paradigms where feedback is unreliable, the MFN is larger for unpredicted negative outcomes than for predicted ones (Gehring &

Willoughby, 2002; Potts et al., 2006; Yeung & Sanfey, 2004). In addition, participant response is not required for MFN elicitation (Potts et al., 2006; Yu & Zhou, 2006).

The results obtained by Potts et al. (2006) illustrate these characteristics. Instead of a forced-choice paradigm, this study used a passive S1/S2 prediction procedure, in which no participant response was required. The S1 predicted the S2 with 80% reliability, and the S2 indicated a monetary gain ($1) or no reward ($0). Under these conditions, an MFN was elicited in response to presentation of an unpredicted unrewarding S2. In addition, a positivity in the same time window was observed for unpredicted monetary gains. This response pattern is consistent with dopamine release, which is secreted in a phasic burst following outcomes that are better than expected, but is inhibited following outcomes that are worse than expected (Schultz, Dayan, & Montague, 1997). Combined, these findings indicate that the MFN is a general negative reward prediction signal (Nieuwenhuis et al., 2004; Potts et al., 2006; Yu & Zhou, 2006). As such, it serves as an unambiguous index of subjective outcome valence. Previous research by Yakub and Potts (2010, 2011) examined MFN reactivity during affective evaluations of image valence in a passive S1/S2 prediction paradigm similar to that used by Potts et al. (2006). In this series of studies, the S2 consisted of high-arousal emotional images with either a positive or negative valence. An MFN difference was observed between unpredicted images with a negative valence and unpredicted images with a positive valence (Yakub & Potts, 2010). This suggests that the MFN may be useful for differentiating appetitive and aversive responses to photographic images, including erotic images. However, this effect was small, and it was not replicated in further study (Yakub & Potts, 2011). A specific examination of responses to erotic images embedded within

this paradigm also failed to demonstrate MFN reactivity, though other ERPs were affected uniquely by erotic images. This does not rule out the possibility that erotic image processing uses the reward-related pathway indexed by the MFN, as the previous study was designed to examine responsivity to emotional images generally, not erotic images specifically. Walters et al. (2008) demonstrated that the ACC is differentially responsive to positive and negative sexual images using fMRI methods. If this ACC responsivity is reflected in the MFN, differential MFN reactivity may serve to distinguish between appetitive and aversive responses to erotic images. If a predictor indicates that an appetitive erotic image will appear, and an aversive erotic image unexpectedly appears instead, this would constitute an unpredicted negative outcome, and as such should result in an increased MFN.

As mentioned previously, Yakub and Potts (2011) found that other ERPs were affected by emotional and erotic images, including the late positive potential (LPP) and positive frontal slow wave (FSW). Both of these components were potentiated while viewing erotic images compared to other high-arousal emotional images (Yakub, Bond, & Potts, in preparation). The LPP is a centroparietal positivity occurring between 300-900 ms post-stimulus that is reliably affected by evaluative judgments, including those made during emotional image processing (Cacciopo, Crites, Gardner, & Berntson, 1994; Cuthbert, Schupp, Bradley, Birbaumer, & Lang, 2000; Rozenkrants, Olofsson, & Polich, 2008). The LPP may be a special case of the P300, which indexes expectancy violation generally; the LPP may index expectancy violation specifically in the domain of affective evaluation (Cacciopo, Crites, Berntson, & Coles, 1993). LPP magnitude increases with image arousal rating, with a larger increase during processing of negatively valenced

images compared to positively valenced images (Cuthbert et al., 2000; Ito, Larsen, Smith, & Cacciopo, 1998). However, this negativity bias is not always observed. In a two-choice gambling task with monetary outcomes, the LPP was not reactive to outcome valence, instead responding differentially to outcome magnitude alone (Yueng & Sanfey, 2004), corresponding to image arousal rating instead of valence. This makes the relationship between LPP response and affective valence unclear. FSW reactivity during affective image evaluation is even more tenuous. FSW elicitation has been more thoroughly studied in working memory tasks, where engaging working memory elicits a positive frontal slow wave which increases in amplitude as load increases (Bosch, Mecklinger, & Friederici, 2001; Ruchkin, Johnson, & Ritter, 1991). A lateralized FSW can also be observed for words embedded in a list that are subsequently recalled, compared to those that are not recalled (Kamp, 2010). In an emotion-related context, the FSW was elicited when participants were directed to attend to the emotional content of images to perform a task, but not when participants attended to non-emotional characteristics of these images (Diedrich, Naumann, Maier, & Becker, 1997). Though research linking FSW and affective or evaluative responses is scarce, prior research by this author indicates that specifically erotic images can elicit a larger FSW in passive prediction tasks compared to other high-arousal emotional images (Yakub & Potts, 2011). One explanation used in both emotion and memory research is that the FSW is generated through activation of neural networks that grant preferential access to cognitive resources, including access to working memory and/or long-term memory. This is consistent with non-ERP research in which erotic content distracts from other cognitive tasks, but facilitates memory for the stimulus (Wright & Adams, 1999).

While MFN responsivity in homophobic men is the most direct test of hypothesized reaction formation, these additional ERPs may be used to characterize homophobic men's perceptions of homosexual erotic images in a more fine-grained fashion, particularly if differential response patterns are related to self-reported homophobia.

Summary and hypotheses

Substantial evidence indicates that reaction formation may be a causal factor of male homophobia, reflecting psychological defense against some degree of homosexual desire. If this is true, homophobic men would experience an appetitive reaction to male homosexual erotica despite this being considered unacceptable by these men. Because the MFN is an indicator of outcome valence, we designed a stimulus prediction study to elicit a valenced MFN in response to unpredicted erotic images. We predicted that heterosexual erotic images would be appetitive to straight-identified men regardless of homophobia, thus eliciting no MFN in response to unpredicted heterosexual images. If the reaction formation hypothesis is correct, homosexual erotic images would be appetitive to men who report high homophobia, while there is no reason to expect this to be true for non-homophobic men. Because of this, we expect an MFN in response to unpredicted same-sex images in non-homophobic men, which should be absent in homophobic men. If an MFN is observed in homophobic men while viewing unpredicted homosexual erotic images, this would disconfirm covert attraction to the same sex as the source of overt homophobia.

Differential responsivity of the LPP and FRN to homosexual images compared to heterosexual images may also shed light on how these images are processed. Increased

LPP amplitude would indicate that the images violate affective expectancies, while increased FSW amplitude would suggest that the image content has increased access to neural resources such as working memory. Neither of these measures speaks directly to the affective valence of the erotic stimuli. However, differences across participants by homophobia would confirm that homophobia is related to the perception of these erotic stimuli. This would be consistent with a reaction formation hypothesis, which holds that homophobia co-occurs with covert attraction to the same sex.

METHODS

Participants

Sixty-three heterosexual men over the age of eighteen were recruited from the University of South Florida undergraduate SONA participant pool. One participant withdrew from the study, and fourteen additional participants were not included in the analysis due to unusable or missing ERP data, typically due to excessive EEG artifact or computer malfunctions during data collection. All participants gave ongoing informed consent throughout the experiment, and participants were compensated with course credit through the USF Psychology department.

Demographic assessment. Average participant age was 20.3 years old (Min 18, Max 30). Participants were 54% white and 30% Hispanic. See Table 1 for a detailed description of participant race and ethnicity. All participants reported both sex and gender identity as male. In addition, participants rated their sexual orientation as "exclusively heterosexual" on both a 5-point and 7-point Likert-type scale. The demographic assessment can be viewed in Appendix A in its entirety.

Inclusion criteria. Participants were screened for age, sex, gender identity, and sexuality using the SONA participant pool demographic exclusion. Participants were only able to view and sign up for the study if they were heterosexual English-speaking males between 18 and 55 years old with normal or corrected-to-normal vision.

Exclusion criteria. The undergraduate SONA sign up page for this study contained text asking students not to participate if they have any current psychoactive

substance abuse or a history of substance dependence, if they are under treatment for psychiatric disorder, using any current medications use that might affect physiological responses, or have a history of neurological injury or disease.

Power evaluation. Before recruitment, it was calculated that forty-eight participants would provide 80% power for detection of a moderate effect size with three predictors. While additional participant data collection was initially desired for detection of smaller yet still meaningful effects, practical considerations limited data collection to 48 participants. Based on expected early withdrawal and data loss, recruitment of 70 participants was initially planned. Participant recruitment ceased when 48 usable EEG data sets were collected.

Materials

The stimuli were comprised of 422 still photographs of nude or mostly-nude adult couples engaged in consensual sexual activity, acquired from public websites which have their images indexed in popular image-specific search engines such as Google Images or Flickr. (An index of all images used, as well as the images themselves, are included as supplemental materials.) Each participant viewed 400 total images, 200 of which were of same-sex male couples, and 200 of which were opposite-sex couples. These images included foreplay (kissing, undressing, etc.), oral sex, and intercourse, with each category comprising roughly one third of the images.

Stimulus set characterization. These images were rated by participants along the dimensions of emotional valence and arousal using the Self-Assessment Manikin (SAM, Bradley & Lang, 2006). The SAM uses illustrated image ratings, both on a scale of 1-9. Valence rating options range from extremely unpleasant (1) to extremely pleasant (9),

while arousal rating options range from no emotional impact (1) to extremely high emotional impact (9). Due to time constraints, participants did not rate the entire set of images. Each participant rated 60 total images, randomly selected from the image set with the following constraints: half of these images were heterosexual and half homosexual, and within these categories a third portrayed foreplay, a third portrayed oral sex, and a third portrayed intercourse. The participant rating instructions are displayed in Appendix B.

Assessment of homophobia. Homophobia was assessed using the Modern Homophobia Scale for Gay Men (MHS-G), a commonly used measure which takes personal discomfort, personal prejudice, and institutional discrimination into account (Raja & Stokes, 1998). Participant homophobia scores ranged from a minimum of 39 to a maximum of 110. The Cronbach's alpha for the 22 items of this scale was .92. Using appropriate reverse coding as detailed in Appendix C, items on the MHS-G were summed to generate a single homophobia score for each participant. Participants were divided into homophobia groups by taking a median split (Mdn = 88.5) of the distribution of homophobia scores. This resulted in two groups: homophobic men (M = 72.9), and non-homophobic men (M = 92.5).

Procedure

Participants gave informed consent before any other experimental procedures began. They filled out the demographic form, which was then checked to ensure all participants self-reported exclusive heterosexuality. Participants were then fitted with a 128-channel electrode net and seated. Participants viewed the above-described erotic images on a computer screen in a passive two-stimulus prediction design. The first

stimulus (S1) predicted with 80% accuracy whether the second stimulus (S2) features a same- or opposite-sex couple. The S1 in this experiment was either a yellow square or a blue circle, and the predicted S2 for each S1 was counterbalanced across participants. Before the experiment began, S1/S2 predictive relationships were explicitly instructed to participants. One S1 predicted a homosexual erotic image; that is, it was followed by an image depicting a same-sex couple 80% of the time (predicted same-sex), while 20% of the time it was followed by an image depicting an opposite-sex couple (unpredicted opposite-The other S1 similarly predicted a homosexual erotic image with the same likelihood: 80% predicted opposite-sex, and 20% unpredicted same-sex. The predictive shapes were presented for 250 miliseconds, while the erotic stimuli were presented for 1000 milliseconds. The inter-stimulus interval was between 500 and 700 milliseconds, determined randomly trial-by-trial. A sample trial is depicted in Figure 1.

There were 400 trials total; 160 trials were predicted same-sex, 160 were predicted opposite-sex, 40 were unpredicted same-sex, and 40 were unpredicted opposite-sex. The inter-trial interval was between 250 and 450 milliseconds, also determined randomly trial-by-trial. These trials were divided into 4 blocks, each containing 100 trials. Within blocks, trial selection was randomized given the constraints listed above, with the probabilities of each trial type held constant within each block. S2 image selection was also randomized for each trial, also given the constraints listed above. No post-trial feedback was given.

After 400 such trials, the EEG portion of the experiment ended and the electrode nets were removed. Participants then viewed a sample of 60 erotic images and rated

them on the SAM as described above. After SAM ratings were given, participants completed the MHS-G, and they were then dismissed from the experiment.

EEG collection, processing, and analysis

EEG data was collected with a 128-channel EGI system (Electrical Geodesics, Eugene, OR), sampled at 250 Hz, and referenced to the vertex with 0.1–100 Hz analog bandpass filtering. A 30-Hz low-pass digital filter was applied, and the resulting recording was segmented into 1000-ms epochs spanning 200 ms before to 800 ms after S2. These were screened for noncephalic artifacts, and uncorrupted trials sorted by condition and averaged within subjects. Individual subject ERPs were baseline corrected over the 200-ms prestimulus period and transformed into an average reference representation. Medial frontal and central parietal electrodes were selected (see Figure 2) and means across these montages were taken to generate grand average waveforms. LPP values were extracted from the mean voltage 350-500 ms post-stimulus over central parietal electrodes, and FSW values were extracted from the mean voltage 250-500 ms post-stimulus.

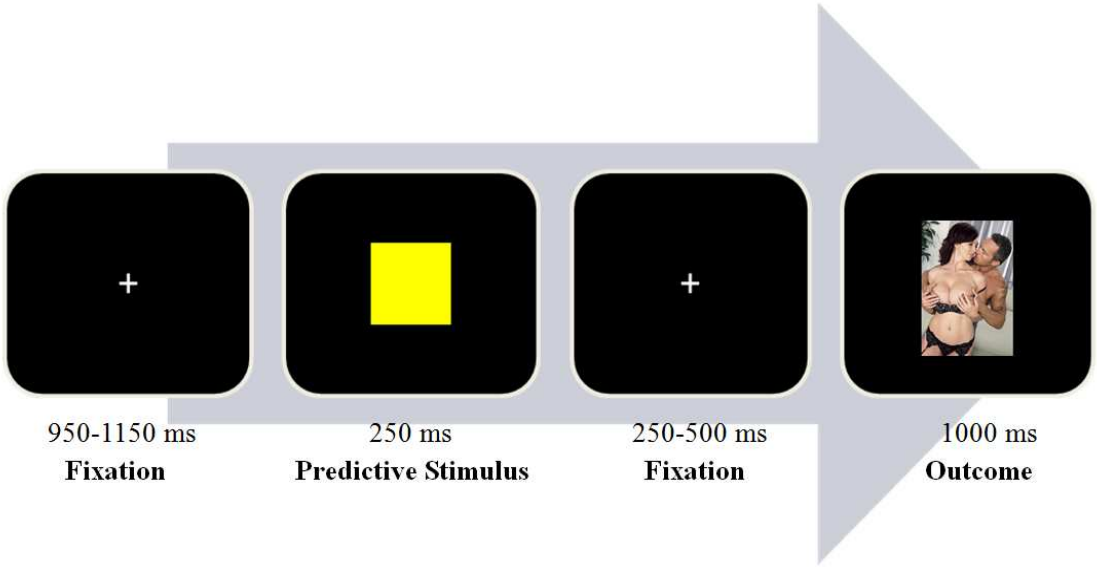

*Figure 1. Graphical representation of a sample trial with a yellow square S1 and a heterosexual erotic S2. The outcome predicted by each S1 was counterbalanced across participants and explicitly instructed at the beginning of the experiment.*sex).

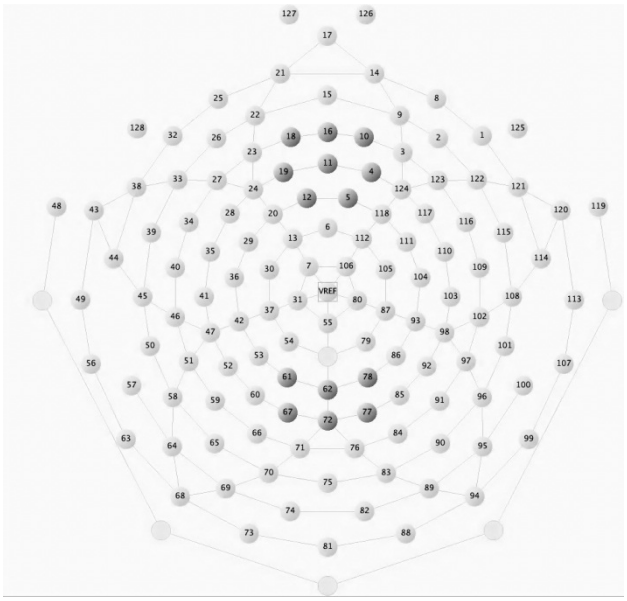

Figure 2. Selected electrodes which were used to construct frontal and parietal waveforms.

Table 1: Participant race and ethnicity

Race	n	% of total
American Indian	1	1.59
Asian	6	9.52
African American	7	11.11
Pacific Islander	0	0
White	34	53.97
Other	12	19.05
Multiple	1	1.59
None Listed	2	3.17
Ethnicity	**n**	**% of total**
Hispanic	18	28.57
Non-hispanic	44	69.84
None Listed	1	1.59

Note. n = number of participants;
% of total = percent of participants.

RESULTS

Participant characteristics and image ratings.

MHS-G differences were highly significant between the homophobia groups, $t(94) = 10.1$, $p < .001$. There were no differences in erotic image viewing frequency between homophobic and non-homophobic participants, $t(94) = 0.20$, $p = .84$.

Image SAM ratings and reaction times were analyzed using two-way factorial ANOVAs, with image content as a within-subjects variable and homophobia group as a between-subjects variable, followed by. Participants reported positive valence ratings on the SAM for heterosexual images (M = 5.43) and negative valence ratings for homosexual images (M = 2.42). Both main effects of homophobia and image content on valence ratings were significant, as well as the interaction between them, all $F(1,39) > 4.5$, all $p < .05$. The same pattern of significant results was found for SAM valence rating reaction time. The full ANOVA results for valence ratings and response times are displayed in Tables 2 and 3, respectively. Post-hoc two-tailed t-tests reveal that homophobic participants rated homosexual images lower on SAM valence than non-homophobic participants, $t(94) = 3.70$, $p < .001$, and their SAM responses to homosexual images were made with significantly shorter reaction times than those of non-homophobic participants, $t(94) = 2.96$, $p = .0039$.

SAM arousal ratings for both heterosexual images (M = 4.33) and homosexual images (M = 4.92) were moderate, with trend-level differences found among all conditions, $F(1,39) < 3.76$, $.05 < p < .05$. Similar post-hoc tests reveal again that

homophobic participants rated homosexual images higher on SAM arousal than heterosexual images, $t(94) = 2.27$, $p = .025$. No significant effects on arousal rating reaction time. SAM arousal rating and reaction time ANOVA results are displayed in Tables 4 and 5. SAM means and all Student's t-tests regarding differences between homophobia groups are listed in Table 6, and a selection of these results are graphically displayed in Figure 3.

ERP differences.

Tables 7 and 8 show all ERP means for homophobic and non-homophobic men, respectively. The MFN did not appear to be responsive to the erotic stimuli used in this experiment. Figure 4 shows the medial frontal grand average waveform where the MFN would be visible if present. As such, MFN means were not extracted from the ERP waveforms and no analyses were performed with the MFN as a dependent measure.

Frontal slow wave means were extracted from ERP segments 250-500 ms post-stimulus over medial frontal electrodes, and LPP means were extracted from ERP segments 350-500 ms post-stimulus over central parietal electrodes. Two repeated measures mixed factorial ANOVAs were performed to determine significant differences in FSW and LPP response, respectively. Within-subjects factors included image content (homosexual, heterosexual) and prediction (predicted, unpredicted), with homophobia (high, low) as a between-subjects factor.

In the FSW window, there was a main effect of image content, $F(1,46) = 77.44$, $p < .001$; images with heterosexual content elicited a more positive deflection in the FSW than images with homosexual content. A significant interaction was found between image content and prediction, $F(1,46) = 4.86$, $p = .03$, $\eta^2 = .96$. However, post-hoc two-tailed

paired samples Student's t-tests revealed a trend-level simple effect of prediction in heterosexual images only. Unpredicted heterosexual images produced a trend towards more positive deflection than predicted heterosexual images, $t(47) = -1.76$, $p = .085$, while prediction did not affect the FSW for homosexual images, $t(47) = -.046$, $p = .64$. The waveforms in Figure 4 show this interaction. FSW response in homophobic men was more positive overall compared to non-homophobic men, a difference which nearly reached significance, $F(1,46) = 3.88$, $p = .055$, $\eta 2 = .078$. This difference is highlighted in Figure 5. Full FSW ANOVA results can be found in Table 9.

The only significant difference in LPP response was a main effect of image content, $F(1,46) = 6.81$, $p = .012$, $\eta 2 = .129$. Larger LPPs were elicited while viewing heterosexual images compared to homosexual images, displayed in Figure 6. Full LPP ANOVA results can be found in Table 10. In addition, correlations between all study variables can be found in Table 11. These correlations confirm the effects found by the planned ANOVAs.

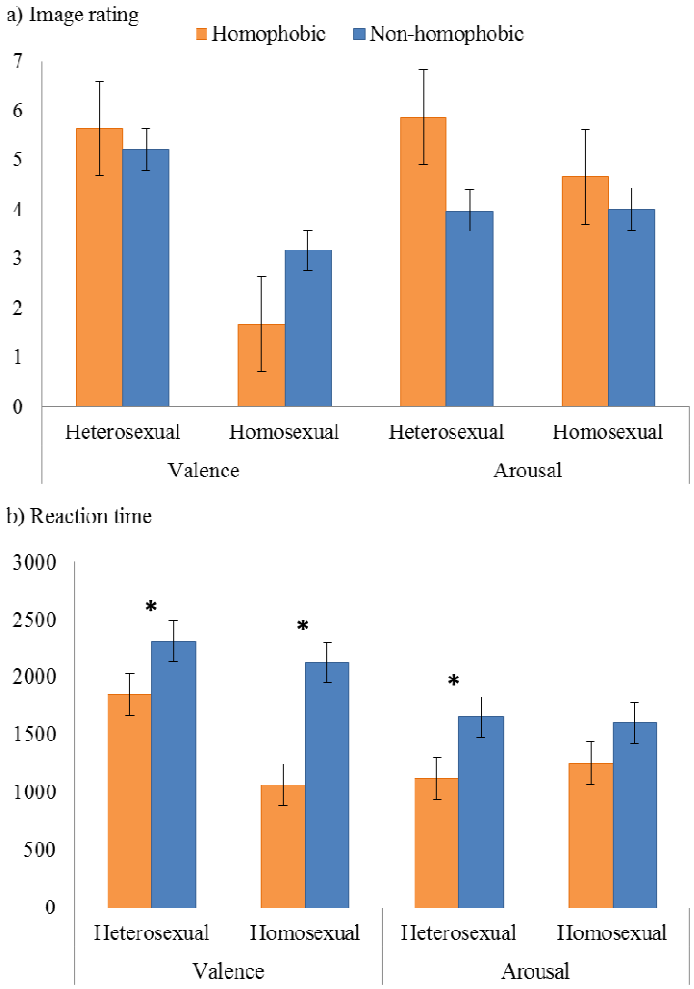

*Figure 3. Participant rating (a) and reaction time (b) during Self-Assessment Manikin rating of a sample of 60 study images. Valence and arousal ratings are on a scale of 1-9. A rating of 1 signifies negative valence or low arousal, 9 signifies positive valence or high arousal, respectively. * $p < .05$.*

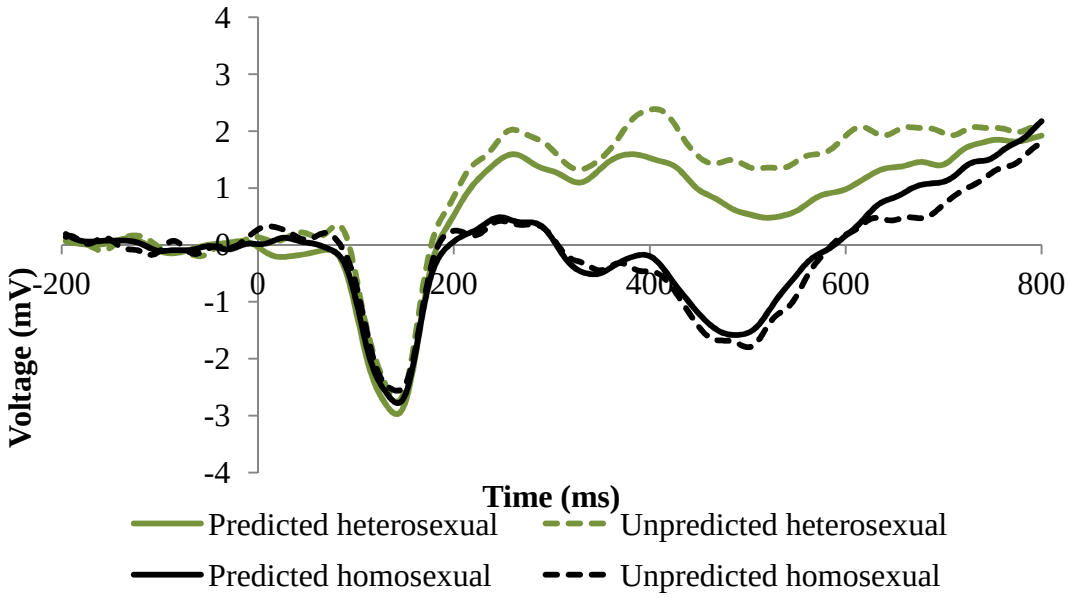

Figure 4. Grand average waveform over medial frontal electrodes. In the FSW window (250-500 ms post-stimulus) there is a significant interaction between image content and prediction, $p < .05$. No sharp negative deflection characteristic of the MFN is present.

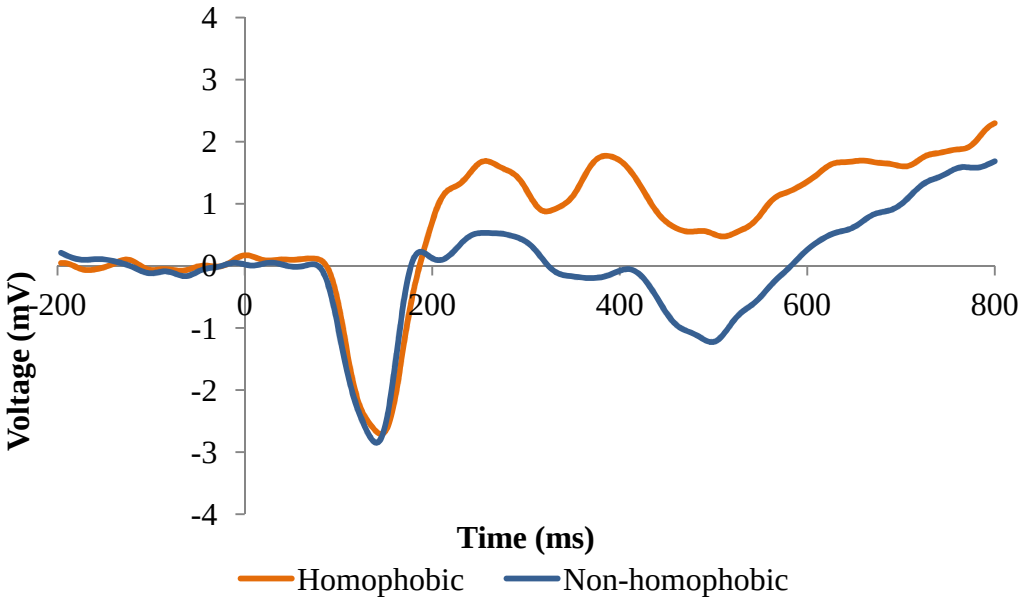

Figure 5. Average frontal waveform seperated by homophobia group. Homophobic men have a trend-level more positive FSW (250-500 ms post-stimulus), p = .055.

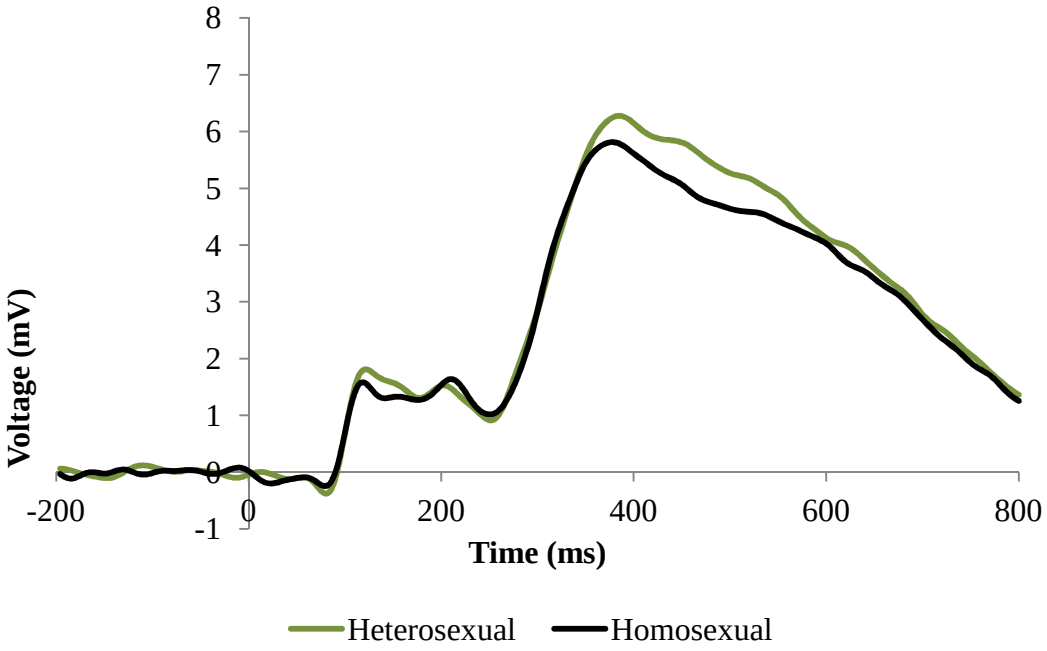

Figure 6. Grand average parietal waveforms displaying the significant effect of image content on LPP response in the 300-500 ms post-stimulus window, $p < .05$.

Table 2: ANOVA results for differences in SAM valence ratings

Source	SS	df	MS	F	p	Partial η2	Power
Homophobia	7.81	1	7.81	4.57	.039	.105	.550
Error (Homophobia)	66.68	39	1.71				
Image content	197.45	1	197.45	73.93	.000	.655	1.000
Image content by Homophobia	21.84	1	21.84	8.18	.007	.173	.796
Error (Image content)	104.16	39	2.67				

Note. SS = sum of squares; df = degrees of freedom, MS = mean square.

Table 3: ANOVA results for differences in SAM valence rating reaction times

Source	SS	df	MS	F	p	Partial η2	Power
Homophobia	11774361.89	1	11774361.89	5.57	.023	.125	.634
Error (Homophobia)	82387221.36	39	2112492.86				
Image content	4747724.52	1	4747724.52	28.14	.000	.419	.999
Image content by Homophobia	1830682.13	1	1830682.13	10.85	.002	.218	.895
Error (Image content)	6580484.43	39	168730.37				

Note. SS = sum of squares; df = degrees of freedom, MS = mean square.

Table 4: ANOVA results for differences in SAM arousal ratings

Source	SS	df	MS	F	p	Partial η2	Power
Homophobia	34.93	1	34.93	3.72	.061	.087	.468
Error (Homophobia)	366.55	39	9.40				
Image content	7.39	1	7.39	3.76	.060	.088	.472
Image content by Homophobia	6.37	1	6.37	3.24	.080	.077	.419
Error (Image content)	76.73	39	1.97				

Note. SS = sum of squares; df = degrees of freedom, MS = mean square.

Table 5: ANOVA results for differences in SAM arousal rating reaction times

Source	SS	df	MS	F	p	Partial η2	Power
Homophobia	3905891.70	1	3905891.70	1.91	.175	.047	.270
Error (Homophobia)	79908978.79	39	2048948.17				
Image content	39301.92	1	39301.92	0.37	.545	.009	.092
Image content by Homophobia	170711.68	1	170711.68	1.62	.210	.040	.237
Error (Image content)	4106836.12	39	105303.49				

Note. SS = sum of squares; df = degrees of freedom, MS = mean square.

Table 6: Self-Assessment Manikin results and post-hoc two-tailed paired samples t-tests.

	Heterosexual images				Homosexual images			
	Valence		Arousal		Valence		Arousal	
	Rating	RT	Rating	RT	Rating	RT	Rating	RT
Overall	5.43	2082.03	4.34	1384.14	2.42	1597.18	4.92	1428.34
Homophobic	5.64	1850.74	4.66	1118.34	1.68	1064.79	5.86	1254.47
Non-homophobic	5.22	2313.31	4.01	1649.94	3.17	2129.57	3.98	1602.22
T	0.80	1.41	0.92	1.77	3.70	2.96	2.28	0.97
p	0.42	0.16	0.36	0.080	< .001	< .001	0.025	0.33

Note. RT = reaction time. Significant effects are bolded.

Table 7: Mean ERPs for homophobic men

	Homosexual		Heterosexual	
	Predicted	Unpredicted	Predicted	Unpredicted
MFN	0.54	0.32	2.37	2.47
FSW	0.39	0.03	2.29	2.71
LPP	4.82	4.91	5.49	4.82

Table 8: Mean ERPs for non-homophobic men

	Homosexual		Heterosexual	
	Predicted	Unpredicted	Predicted	Unpredicted
MFN	-0.98	0.63	-0.8	0.84
FSW	-1.2	0.5	-1.15	0.91
LPP	5.57	6.48	5.68	6.37

Table 9: ANOVA results for FSW differences over frontal electrodes

Source	SS	df	MS	F	p	Partial η2	Power
Homophobia	133.33	1	133.33	3.89	.055	.078	0.49
Error (Homophobia)	1577.58	46	34.30				
Image content	204.19	1	204.19	77.44	< .001	.627	1.00
Image content by Homophobia	2.52	1	2.52	0.96	.333	.020	0.16
Error (Image content)	121.29	46	2.64				
Prediction	1.02	1	1.02	0.47	.498	.010	0.10
Prediction by Homophobia	0.52	1	0.52	0.24	.628	.005	0.08
Error (Prediction)	100.46	46	2.18				
Image content by Prediction	6.75	1	6.75	4.86	.033	.096	0.58
Image content by Prediction by Homophobia	0.33	1	0.33	0.24	.627	.005	0.08
Error (Image content by Prediction)	63.92	46	1.39				

Note. SS = sum of squares; df = degrees of freedom, MS = mean square.

Table 10: ANOVA results for LPP differences over parietal electrodes

Source	SS	df	MS	F	p	Partial η2	Power
Homophobia	57.42	1	57.42	1.47	.232	.031	.221
Error (Homophobia)	1798.07	46	39.09				
Image content	11.51	1	11.51	6.81	.012	.129	.724
Image content by Homophobia	1.51	1	1.51	0.89	.350	.019	.152
Error (Image content)	77.74	46	1.69				
Prediction	0.88	1	0.88	0.86	.358	.018	.149
Prediction by Homophobia	0.88	1	0.88	0.86	.358	.018	.149
Error (Prediction)	46.99	46	1.02				
Image content by Prediction	2.30	1	2.30	1.81	.185	.038	.261
Image content by Prediction by Homophobia	0.13	1	0.13	0.10	.750	.002	.061
Error (Image content by Prediction)	58.32	46	1.27				

Note. SS = sum of squares; df = degrees of freedom, MS = mean square.

Table 11: Correlations between study variables

		View Freq	MHS	MFN	FSW	LPP	Het Val	Het Val RT	Het Aro	Het Aro RT	Homo Val	Homo Val RT	Homo Aro	Homo Aro RT
View Freq	*r*	1	.113	.159	.153	-.148	.157	.129	.140	.142	-.114	.075	-.069	.092
	p		.451	.286	.306	.322	.332	.426	.389	.383	.485	.647	.671	.574
	N	47	47	47	47	47	40	40	40	40	40	40	40	40
MHS	*r*	.113	1	-.155	-.177	.132	-.131	.259	-.244	.223	.469**	.394*	-.261	.175
	p	.451		.291	.229	.372	.414	.103	.124	.161	.002	.011	.100	.273
	N	47	48	48	48	48	41	41	41	41	41	41	41	41
MFN	*r*	.159	-.155	1	.981**	-.161	.460**	-.208	.041	-.063	-.109	-.255	.241	-.156
	p	.286	.291		.000	.275	.002	.192	.799	.694	.497	.108	.129	.330
	N	47	48	48	48	48	41	41	41	41	41	41	41	41
FSW	*r*	.153	-.177	.981**	1	-.223	.507**	-.216	.070	-.062	-.165	-.264	.249	-.139
	p	.306	.229	.000		.128	.001	.176	.666	.700	.301	.096	.116	.387
	N	47	48	48	48	48	41	41	41	41	41	41	41	41
LPP	*r*	-.148	.132	-.161	-.223	1	-.170	.006	.179	-.071	.212	.121	.263	-.074
	p	.322	.372	.275	.128		.287	.971	.263	.658	.184	.451	.096	.646
	N	47	48	48	48	48	41	41	41	41	41	41	41	41
Het Val	*r*	.157	-.131	.460**	.507**	-.170	1	.216	.185	.228	-.243	.189	.223	.314*
	p	.332	.414	.002	.001	.287		.175	.248	.152	.125	.238	.161	.045
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Het Val RT	*r*	.129	.259	-.208	-.216	.006	.216	1	-.155	.780**	.038	.845**	-.058	.801**
	p	.426	.103	.192	.176	.971	.175		.334	.000	.814	.000	.720	.000
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Het Aro	*r*	.140	-.244	.041	.070	.179	.185	-.155	1	-.051	-.195	-.148	.664**	-.031
	p	.389	.124	.799	.666	.263	.248	.334		.753	.222	.357	.000	.846
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Het Aro RT	*r*	.142	.223	-.063	-.062	-.071	.228	.780**	-.051	1	.093	.781**	-.066	.914**
	p	.383	.161	.694	.700	.658	.152	.000	.753		.562	.000	.681	.000
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Homo Val	*r*	-.114	.469**	-.109	-.165	.212	-.243	.038	-.195	.093	1	.252	-.346*	-.057
	p	.485	.002	.497	.301	.184	.125	.814	.222	.562		.112	.027	.724
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Homo Val RT	*r*	.075	.394*	-.255	-.264	.121	.189	.845**	-.148	.781**	.252	1	-.151	.811**
	p	.647	.011	.108	.096	.451	.238	.000	.357	.000	.112		.347	.000
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Homo Aro	*r*	-.069	-.261	.241	.249	.263	.223	-.058	.664**	-.066	-.346*	-.151	1	.006
	p	.671	.100	.129	.116	.096	.161	.720	.000	.681	.027	.347		.970
	N	40	41	41	41	41	41	41	41	41	41	41	41	41
Homo Aro RT	*r*	.092	.175	-.156	-.139	-.074	.314*	.801**	-.031	.914**	-.057	.811**	.006	1
	p	.574	.273	.330	.387	.646	.045	.000	.846	.000	.724	.000	.970	
	N	40	41	41	41	41	41	41	41	41	41	41	41	41

Note. View freq = Self-reported frequency of viewing erotic images; MHS = Modern Homophobia Scale for Gay Men; Het = heterosexual images; Homo = homosexual male images; Val = SAM valence rating; Val RT = reaction time during SAM valence rating; Aro = SAM arousal rating; Aro RT = reaction time during SAM arousal rating; * indicates the correlation is significant at the 0.05 level (2-tailed); ** indicated the correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

Differences in the MFN.

Contrary to our prediction, the prediction violation design did not elicit an MFN using these erotic stimuli. While there do appear to be differences in the MFN time range of 250-450 ms post-stimulus, these do not resemble the characteristic sharp negative deflection of the MFN. Instead, differences in this region are part of a more persistent deflection that begins to diverge at 200 ms post-stimulus and is sustained for at least 400 ms, more characteristic of a FSW. As MFN responsivity was necessary to assess covert attraction to the same sex, we were unable to use the MFN to test the reaction formation hypothesis of homophobia in this study.

One previous study by Yakub and Potts (2010) did show MFN reactivity to valenced emotional images. As mentioned, this effect was not replicated by Yakub and Potts (2011), nor was it replicated in this study using valenced erotic images. This suggests that the MFN may not be reactive to photographic images at all. MFN responsivity instead appears limited to explicit error feedback (Miltner, 1997) and monetary outcomes that are worse than expected (Potts, et al., 2006; Yeung & Sanfey, 2004). This implies that the MFN is not a truly general signal of outcome valence as commonly proposed (Nieuwenheus et al., 2004, Potts, et al., 2006).

Differences between homophobia groups.

We observed a trend for FSW difference between homophobic and non-homophobic men. The moderate effect size suggests that this may be a real difference

between these groups of men, indicating that homophobic men dedicate more neural resources to the processing of erotic images in general, both homo- and heterosexual, than non-homophobic men.

The SAM ratings indicate that homophobic men find homosexual images to be more negatively valenced and more emotionally arousing than non-homophobic men. The simplest explanation for these results is that homophobic men have an aversive reaction to images with erotic homosexual content. However, homophobic participants also responded significantly faster in making their SAM ratings of homosexual image valence compared to heterosexual image valence, and they responded more than twice as fast during homosexual valence ratings as non-homophobic men (see Table 6). These results are consistent with research that suggests that homophobic men experience anxiety during presentation of homosexual stimuli (Bosson, et al., 2006; Fassinger, 2000, Parrott et al., 2006), as anxiety decreases reaction time during simple classification tasks (Panayiotou & Vrana, 2004). This does not appear to be an accurate, introspective self-report, but may instead reflect a general rejection of homosexual stimuli as an unacceptable violation of gender role norms. In other words, these self-reported aversive responses may be inconsistent with their true internal state, as suggested by the findings of Weinstein et al. (2012).

Differences related to image content.

While no MFN responsivity was observed, both the FRN and LPP responded to image content, with significant increases in both components while viewing heterosexual stimuli among all participants. No direct link exists between the FRN and image valence, but increased LPP amplitude has been linked to negative valence, as the LPP is greater in

response to negative emotional images, compared to positive or emotionally neutral images (Cacciopo et al., 1993; Cuthbert et al., 2000). However, this would lead us to conclude that heterosexual images were negatively valenced as well, contradicting observed participant SAM ratings. In addition, the LPP negativity bias is not a consistent effect across all studies of affective evaluation (Yeung & Sanfey, 2004). As changes in either of these signals do not necessarily relate to whether subjective stimulus evaluations in this study were appetitive or aversive, these effects do not speak directly to our hypothesis.

Heterosexual images produced an increased FSW regardless of homophobia, interacting with prediction such that unpredicted heterosexual images elicited a more positive deflection than predicted heterosexual images, which was not the case for homosexual images. This pattern of results suggests that heterosexual image content is allocated preferential access to frontal-mediated cognitive resources, likely including working memory or long-term memory encoding. As an additional FSW increase for unpredicted heterosexual images approached significance, unexpected heterosexual images may be allocated the most cognitive resources among all conditions. This would imply that preferential access to neural resources is granted to stimuli which violate expectations, consistent with previous research by Potts et al. (2006).

Heterosexual images also elicited a small increase in LPP compared to homosexual images. This suggests that these images violate affective expectations tied to the predictive stimulus. One possible interpretation of this effect is that participants may generally expect to see homosexual images more than they expect to see heterosexual images regardless of predictor.

General discussion.

The results in this study are inconclusive regarding whether homophobic men find homosexual images to be appetitive. The clearest index of response valence, the MFN, did not respond to erotic photographic images in the current design. While this result does add to our understanding of the eliciting properties for the MFN and of the response properties of the reward expectation system the MFN is thought to index (i.e. it appears more responsive to monetary incentives than affective images), it does not provide a test of the reaction formation hypothesis of homophobia. Other ERPs are not conclusively tied to affective valence during erotic image processing, so this limits the possibility of studying covert appetitive responses using ERPs (Olofsson et al., 2008).

However, the responsivity of the LPP and FSW did reveal some information regarding the perception of erotic images generally. Taken together, this set of ERP responses suggests that self-described straight men process heterosexual erotic images differently from homosexual erotic images regardless of homophobia. The LPP and FSW increased in response to heterosexual images compared to homosexual images in all participants, suggesting that they violate affective expectancies and that they are allocated more cognitive resources, respectively, and this response was not modified by self-reported homophobia. This suggests that heterosexual images are preferentially processed, consistent with previous research on erotic content's effects on memory, cognition, and ERPs (Wright & Adams, 1999; Yakub & Potts, 2011). However, it cannot be certain that these results are reflective of neural processing related to sexual interest in general, as only straight-identified men were included in this study. Before generalizing these results to the population as a whole, this research must be replicated and extended.

The possibility that these effects are representative of erotic image processing should be examined through rigorous comparison of appetitive erotic images and non-erotic emotional images, in order to see if there are specific processing differences between erotics and non-erotic stimuli. This possibility was examined in an exploratory analysis during previous study of erotic images by Yakub and Potts (2011), but the procedure used was not designed for this comparison, and as such erotic images comprised only a very small proportion of the stimuli. An ERP study should be designed in which erotics and non-erotics appear with equal frequency, and in which the valence and arousal ratings are more tightly controlled among comparison groups. The comparison between ERP responses to appetitive erotic stimuli and appetitive (i.e. highly positive) non-erotic emotional images would be particularly informative as to whether these differences are due to specifically sexual interest, as that would adequately control for self-reported valence and arousal. In addition, the same erotic stimulus set in this study could also be shown to a sample of exclusively gay men, as gay men's responses would illuminate the ERPs elicited during an appetitive evaluation of homosexual erotic stimuli.

Of particular note are the FSW differences, not only because of the relevant increases in amplitude already discussed, but also because of their unique time course. Other FSW studies examining emotional images typically find slow wave differences beginning between 400-600 ms post-stimulus and extending for seconds (Olofsson et al., 2008), while the sustained differences observed in this study run for 500 ms at best, typically evoked in a 200-700 ms post-stimulus window. Previous study by this author has shown differences for erotic images in this window as well (Yakub & Potts, 2011);

the current study replicates those differences. As these FSW differences are unique both in associated stimulus and in time course, it is possible that FSW responsivity in this window is related specifically to sexual interest in erotic content. If that is the case, it would have a large impact on the interpretation of FSW differences found in this study, particularly the FSW difference between homophobic and non-homophobic men.

Isolating a unique pattern of ERP responses related to sexual interest would also provide a better groundwork for examining whether homophobic men experience covert homosexual attraction. If homophobia is a negative reaction to same-sex attraction in the self, this certainly impacts the way that homophobia should be addressed as a societal problem. Despite the difficulty in studying covert attitudes in men with homophobia, this remains a worthwhile question which should continue to be investigated until a comprehensive, evidence-based answer is found.

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APPENDICES

Appendix A: Demographic assessment form

Sex: _____

Age: _____

Are you right or left handed? RIGHT _____ LEFT _____

Do you have any biological parents, brothers, or sisters who are left-handed?
YES _____ NO _____

How would you describe your ethnicity? Select one:
HISPANIC _____ NOT HISPANIC _____

How would you describe your race? Select one:
AMERICAN INDIAN _____ ASIAN _____
AFRICAN AMERICAN _____ WHITE _____
PACIFIC ISLANDER _____ OTHER _____

Circle the number which best reflects...

Your sexual orientation

Homosexual						Heterosexual
1	2	3	4	5	6	7

How frequently you view erotic images and/or videos

Never						Daily
1	2	3	4	5	6	7

Appendix B: Image valence and arousal ratings.

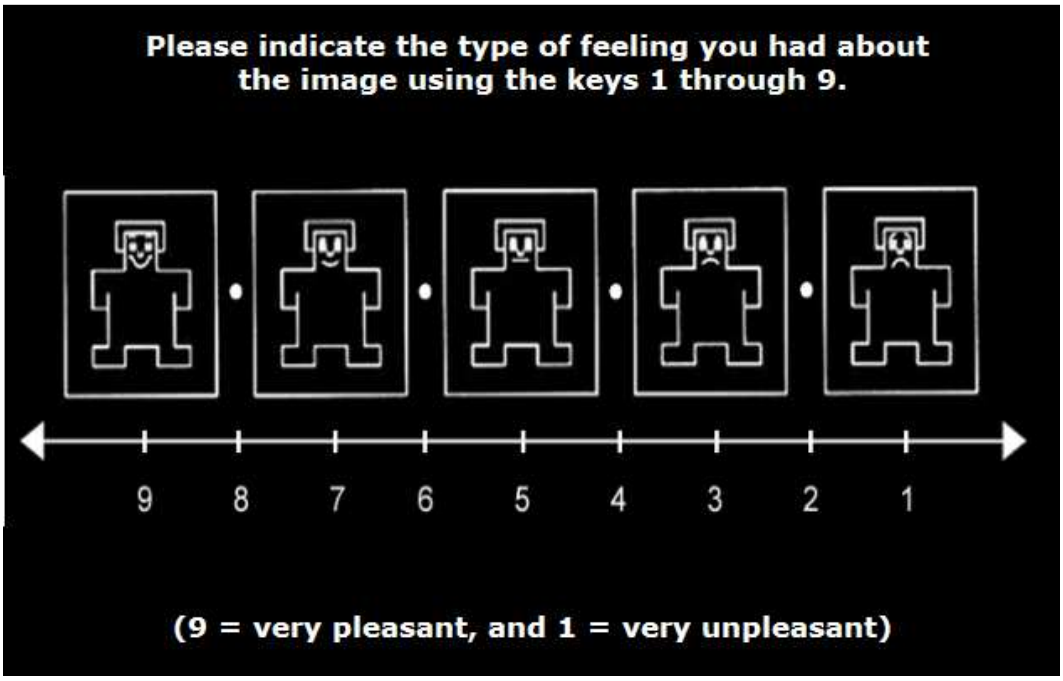

Figure B1: Participant valence rating screen:

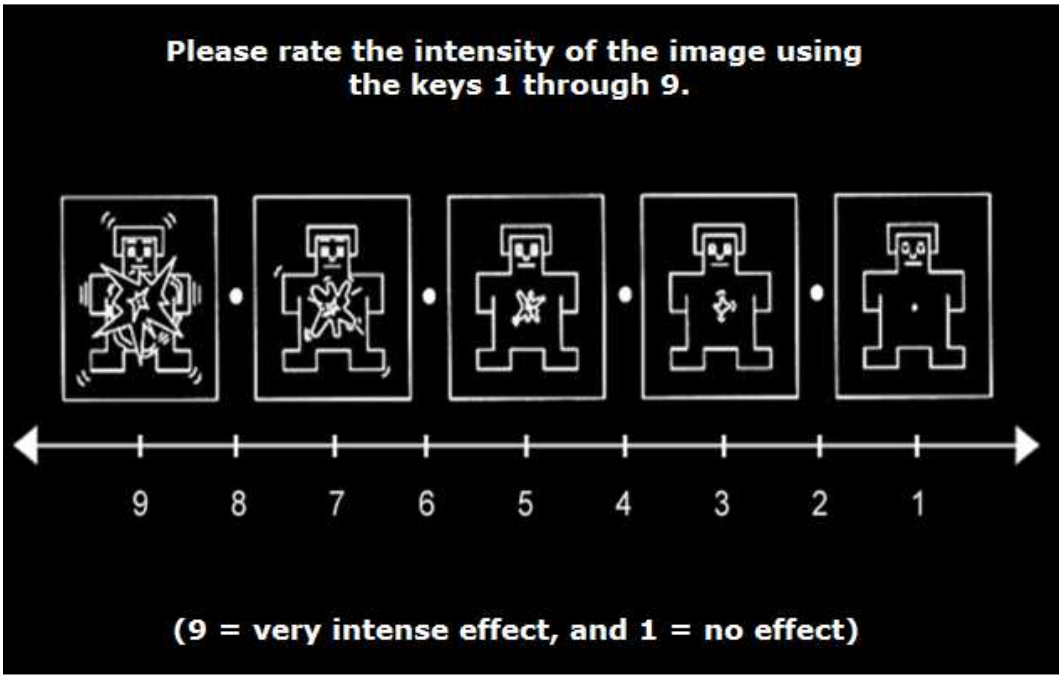

Figure B2: Participant arousal rating screen:

Appendix C: The modern homophobia scale for gay men.

1. I wouldn't mind going to a party that included gay men.
2. I would not mind working with a gay man.
3. I welcome new friends who are gay.
4. I would be sure to invite the same-sex partner of my gay male friend to my party.
5. I won't associate with a gay man for fear of catching AIDS. (R)
6. I don't think it would negatively affect our relationship if I learned that one of my close relatives was gay.
7. I am comfortable with the thought of two men being romantically involved.
8. I would remove my child from class if I found out the teacher was gay. (R)
9. It's all right with me if I see two men holding hands.
10. Male homosexuality is a psychological disease. (R)
11. Physicians and psychologists should strive to find a cure for male homosexuality. (R)
12. Gay men should undergo therapy to change their sexual orientation. (R)
13. Gay men could be heterosexual if they really wanted to be. (R)
14. I don't mind companies using openly gay male celebrities to advertise their products.
15. I would not vote for a political candidate who was openly gay. (R)
16. Hospitals shouldn't hire gay male doctors. (R)
17. Gay men shouldn't be allowed to join the military. (R)
18. Movies that approve of male homosexuality bother me. (R)
19. Gay men should not be allowed to be leaders in religious organizations. (R)
20. Marriages between two gay men should be legal.
21. I am tired of hearing about gay men's problems. (R)

22. Gay men want too many rights. (R)

Participant homophobia score was computed from the mean rating of the following questions from the Modern Homophobia Scale, developed by Raja & Stokes (1998). Participants rated their answer to each question on a scale of 1 to 5; 1 signifying "strongly disagree" and 5 signifiying "strongly agree". Items followed by an (R) were reverse coded. Lower scores indicated higher homophobia.

Appendix D: Text of IRB approval letter

May 13, 2011
Krista Yakub
Psychology
PCD 4118G

RE: Full Board Approval for Initial Review
IRB#: Pro00003029
Title: An electrophysiological study of reward-related ERP responses to explicit erotic images
Study Approval Period: 4/15/2011 to 4/15/2012

Dear Ms. Yakub,
On 4/15/2011 the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents outlined below. Please note that your approval for this study will expire on 4/15/2012.

Approved Items:
Protocol Document(s):
Protocol

Consent/Assent Document(s)
InformedConsent.pdf
InformedConsent_behavioral.pdf

Please note, if applicable, the informed consent/assent documents are valid during the period indicated by the official, IRB-Approval stamp located on the form. Valid consent must be documented on a copy of the most recently IRB-approved consent form. As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,
John Schinka, PhD, Chairperson
USF Institutional Review Board

Cc: Anna Davis, USF IRB Professional Staff