Implicit Sexual Identity Bias as a Function of Religiosity: An Event-Related Potential Study

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Abstract

How are sexual identity biases processed in mind and brain? Does religious belief mediate such prejudice? This experiment explored the priming effects of religiosity on Implicit Association Test (IAT) performance and attempted to identify specific neural correlates of implicit bias via event-related potentials (ERPs). Forty-five participants completed a version of the IAT in which images of heterosexual and homosexual couples were paired with positive and negative adjectives. Prior to each set of trials, participants were primed with four verses of either benevolently themed scripture or persecutory scripture. All participants were exposed to all conditions in counterbalanced orders. Additionally, electroencephalographic (EEG) measurements were recorded during the experiment, and event-related potentials (ERPs) extracted. Three post-experiment questionnaires were used to obtain personality measures of religious fundamentalism, quest, and explicit attitudes toward homosexuality. The results revealed a positive correlation between fundamentalism and enhanced implicit bias, as well as a negative correlation between enhanced bias and quest. As expected, there were significant differences between compatible and incompatible conditions for both altruistic and persecutory verse conditions. Interactions between religious fundamentalism and verse condition, explicit homosexual prejudice and verse condition, and quest and verse conditions in relation to implicit bias were also observed. ERPs yielded N400, early positivity, and late positivity potential differences between high and low religious fundamentalism groups and high and low implicit bias groups. The ERP data revealed fundamentally different brain activity for highly religious participants compared to participants with low religiosity.
Introduction

The Zeitgeist of western culture is evolving, and as it does, attitudes about sexual identity are both changing and resisting change. Although recent progress toward more egalitarian views is evident, homosexuality is still criminalized in more than half of the countries in the world (Williams, 2011). Prejudice is abundant and its consequences are all too real. In September of 2011, for example, three men were executed in Iran for engaging in consensual homosexual relationships (Williams, 2011). Even in the West, prejudice against homosexuals abounds. Gay marriage is currently one of the most contentious issues among Americans, evenly dividing them to an extent that is only rivaled by issues like abortion and euthanasia (Saad, 2008). This is somewhat surprising in a modern, enlightened society in which the gay rights movement is often compared to the civil rights movement of the 1960s (John, 2005). And yet, although the comparison to civil rights is apt, it is the epitome of irony that people like Reverend Bernice King, daughter of Martin Luther King Jr., actively oppose gay rights and denounce homosexuals as “unholy and unnatural” (Lee-St. John, 2005). What is it that enables even fervent proponents of civil rights to so completely embrace prejudice?

William James asserted, “By their fruits ye shall know them, not by their roots” as a kind of prescription for evaluating the usefulness of religious belief (James, 1902). In other words, religion is useful to the degree that it makes us better people; and for the majority of Americans, nothing could be more obvious than the truth of altruism as a consequence of religion. But is it true? Does religion really make us better people? The answer emerging from recent empirical data seems to suggest that religious belief is not so much a high-percentage moral catalyst as it is a mixed bag of tenuous positive effects (e.g. increased charity and self-reported happiness), and
clear negative effects (e.g. prejudice, intolerance, and inter-group conflict) (Graham & Haidt, 2010; Altemeyer, 2003).

**Religion, Prejudice, and Altruism**

In 1954 Gordon Allport (p. 444) argued that religion “makes prejudice and it unmakes prejudice.” Allport and Ross (1967) laid out a foundation for this assertion by distinguishing between two kinds of religiosity: extrinsic and intrinsic. Extrinsic religiosity is motivated primarily by social factors like acceptance or status, and thus causes alignment with social norms. It is a means to an end. Intrinsic religiosity, on the other hand, values religion for its own sake and, therefore, is not a method to achieve other goals. Instead, it is an end in itself. Allport and Ross (and many others since) have argued that individuals with high extrinsic religiosity could account for the relationship between religion and racial prejudice; and they also ascribed opposing effects (i.e. increased racial tolerance) to higher levels of intrinsic religiosity. In other words, religious social climbers are racially biased, but sincerely religious people are universally tolerant and accepting. As with all attempts to categorize personality attributes, the categories in question are only useful to the degree that their predictive validity is empirically supported.

Meta-analytic data measuring religion and racism reveal that extrinsic religiosity is indeed positively correlated (r = .17) and intrinsic religiosity negatively correlated (r = -.07) with racism (Hall, Matz, & Wood, 2010). On the surface, then, it appears that Allport and Ross’ distinction was correct, and that those who are religious for social reasons can primarily account for religious prejudice. In this light, intrinsic religiosity (i.e. religion for its own sake) appears as a benign if not altruistic force counteracting prejudice. Others have taken the notion of religion’s ability to enhance tolerance even further, suggesting that the accumulated evidence for a link between prejudice toward homosexuals and religiosity is the result of a failure to effectively
distinguish homosexuality from homosexual people (Ford, Brignall, VanValey, & Macaluso, 2009). In other words, they argue it is possible to hate the sin but love the sinner. Two studies presented by Ford et. al (2009) demonstrate that when the personality traits of right-wing authoritarianism (RWA) and political conservatism are controlled, Christian beliefs and self-reported homosexual prejudice are not correlated. They argue this demonstrates that prejudice against homosexuals is solely attributable to broader personality characteristics (i.e. RWA) and/or political ideology (i.e. conservatism). This reasoning is routinely used to explain religious extremism and violence in the world. Ford et al. further conclude that “when controlling for authoritarian processes, the internalization of orthodox Christian beliefs serves as a basis for greater tolerance and acceptance of out-groups, including homosexuals” (Ford et. al, 2009, p.156).

Unfortunately, Ford et al.’s results are handicapped by some major internal validity issues. One problem is that they fail to distinguish the degree to which religious fundamentalism and RWA are inter-correlated. Altemeyer (2003, p.18) revealed that, “scores on the Religious Fundamentalism scale typically correlate in the .70s with responses to the Right-Wing Authoritarianism scale.” This means that when RWA is excluded, fundamentalism is also largely dismissed. That is a problem if, as the author argues later, fundamentalism is an accurate measure of the conviction of a person’s religious beliefs. A second problem is that their experimental design is based entirely on self-report data; and self-report measures are particularly problematic in studies of religious belief - especially those that distinguish extrinsic and intrinsic religiosity. Sedikides and Gebauer (2010) conducted a meta-analysis (expanding on a meta-analysis by Trimble, 1997) revealing strong support for the hypothesis that self-enhancement (i.e. self importance) in the form of socially desirable responding (SDR) drives
religiosity. In other words, a desire for social acceptance and high moral status strongly motivates people to be religious. This is especially true of intrinsic religiosity which correlates significantly with impression management (i.e. adjusting responses according to reputational concerns) \((r = .31)\). Further, this relationship is stronger in countries that are more religious (e.g. the United States) versus those that are less religious (e.g. the United Kingdom) and at religious colleges versus secular universities. The more religious a particular community, the more SDR drives increased religiosity (as measured by self-report) in the population.

The strength of SDR as an explanation for even well-established positive effects of intrinsic religiosity is confirmed by signal detection analysis of experiments on over-claiming (Sedikides et. al, 2010; Paulhus, Bruce, Harms, & Lysy, 2003). For example, highly intrinsically religious people “manifested a pattern of overclaiming” on tasks that had built in fabricated domains to allow for signal detection on both religious topics “(e.g., ‘famous biblical verses’)” and community topics “(e.g., ‘charities’)” (Sedikides et. al, 2010, p.31). So, when experimenters include fictitious stimuli in their experimental designs and use it as a guide to calculate the level of over-claiming, religiosity significantly increases participant fabrication. These results should increase our hesitancy to place too much weight on self-report data as an accurate representation of religious enhancements to prosocial behavior. In further support of this skepticism, Norenzayan and Shariff (2008) conducted several experiments demonstrating that religious enhancements of prosocial behavior occur only when recipients are in-group members and these behaviors are reputationally motivated. Additionally, Sedikides and Gebauer (2010) revealed that many previously well-established positive correlations between religiosity and prosocial behavior, including those exposed by Norenzayan and Shariff (2008) as being in-group selective, disappear when over-claiming is controlled. Norenzayan and Shariff (2008, p.60) further
discovered that “religiosity predicts prosocial behavior primarily when the prosocial act could promote a positive image for the participant, either in his or her own eyes or in the eyes of observers.” So, it seems the evidence suggests religion causes people to claim they behave better than they actually do; and that when people are motivated to do good things by their religion, it is very likely they are doing so, in large part, to enhance their reputation. Of further interest, Norenzayan and Shariff (2008, p.62) also discovered that “experimentally induced reminders of secular moral authority had as much effect on generous behavior in an economic game as reminders of God.” It seems that even the limited benefits of increased altruism within personal in-groups are equally achievable in the absence of religious belief.

Some scientists, however, do not buy into the efficacy of religious belief as a result of specific propositions (Graham & Haidt, 2010). These scientists question the alleged superiority of intrinsic religiosity, as well as the broader approach of viewing religion in terms of benefits and costs to the individual. Instead, Haidt and Graham (2010) argue that the vast majority of the benefits of religiosity are the direct result of community building, and that if you remove the social elements of religious practice, the remaining beliefs confer no significant benefit on the believer. In other words, religion has evolved to facilitate interpersonal cooperation. Haidt and Graham admit, of course, that the antisocial baggage of religion balances its prosocial benefits; and, as mentioned previously, the evidence indicates that enhanced in-group cooperation has a dark side in addition to its extreme selectivity in that it seems to facilitate enhanced out-group prejudice (Norenzayan et al., 2008).

**Personality Measures**

In light of the problematic distinctions between the concepts of extrinsic and intrinsic religiosity, researchers have attempted to hone in on more specific and accurate personality
variables. Some of these variables have been widely used including right-wing authoritarianism (RWA), religious fundamentalism (RF), christian orthodoxy (CO), religious ethnocentrism (RE), and religious quest (Altemeyer & Hunsberger, 1992; Altemeyer, 2003; Rowatt, Tsang, Kelly, LaMartina, McCullers, & McKinley, 2006). RWA is a more general personality characteristic, but all of the other variables just mentioned are explicitly religious. CO is a measure of the specific content of Christian beliefs, while RF exceeds the boundaries of a specific religion and is described as “an attitude toward whatever beliefs one [holds] - for example, that they contain the fundamental, basic, intrinsic, essential, inerrant truth about humanity and deity” (Altemeyer et. al, 1992; Altemeyer, 2003, p.18). As such, CO can be thought of as a qualitative measure (i.e. representing specific propositional content), while RF is more of a quantitative measure (i.e. representing differences in degree of religious conviction). Quest originated as a measure of religious seeking, but has since been more accurately evaluated in light of empirical reflection as a measure of agnosticism or non-religiousness (Hall et al., 2010; Rowat et al., 2006). Finally, RE is a refined attempt to get at the strength of in-group and out-group distinctions (Altemeyer, 2003).

Although RE is a distinct variable designed to measure ethnocentric responses on a solely religious basis, it is highly correlated with RF (r=.80)(Altemeyer, 2003). One interesting and illustrative finding of Altemeyer (2003, p.23) using RE as a distinct measure is that “as relatively prejudiced as religious fundamentalists tend to be toward racial and ethnic minorities, and toward homosexuals, they are even more likely...to make ethnocentric judgments on religious grounds.” In other words, religion acts as a framework that enhances our natural grouping tendencies, and atheists are the ultimate out-group. Findings like these have led others to conclude that the primary motivational impulses that drive religiosity also strengthen stereotype reliance and out-
group hostility, and therefore deepen prejudice and inter-group conflict (Hall et. al, 2010; Harris, 2005; Norenzayan & Shariff, 2008). In support of this conclusion is research revealing correlations between RF and racism (Hall et. al, 2010), sexism (Hunsberger, Owusu, & Duck, 1999), and prejudice against homosexuals (Rowatt et al., 2006; Altemeyer, 2003; Herek, 1987), although one must be careful not to infer causal relationships on the basis of correlational data alone.

As mentioned previously, it has been proposed that religious prejudices can be explained by RWA, political ideology, and other non-religious factors; and these explanations posit that if you control for the aforementioned confounding variables, religiosity emerges as a benign if not positive counteracting force against prejudice (Ford et. al, 2009). This conclusion is unfounded. It is true that measures of CO (i.e. specific beliefs) are not correlated with racial prejudice when RF is controlled (Altemeyer et al., 1992); and, although CO is positively correlated with sexual identity prejudice, a large portion of this prejudice seems to be attributable to RF (Rowatt et al., 2006). However, the conclusion to draw from these results is not that CO is benign, but rather that it is merely a necessary but perhaps not sufficient condition for - at least Christian - religious prejudice. CO represents content; but the content of specific religious beliefs is trivial if the strength with which people actually believe them is low. The degree to which people really believe a specific set of religious propositions seems to be most accurately captured in the measure of RF. In this light, RF can be seen as a measure of faith. In support of this assertion, Hunsberger and Jackson (1999, p.519) found that CO and RF were highly correlated; that in-group favoritism is related strongly and equally to RF and CO; and that - among religious people - “prejudice against religious outgroups is pervasive among more religious individuals, regardless of personal religious orientation.” In other words, the explanation that religious
Prejudice is attributable to fringe groups within particular religions, and that the broader effects of religion are universally altruistic appears to be false. Religious groups function in the same way that all other groups function - and they are vulnerable to the same biases and systematic errors (Hunsberger et al., 1999). In fact, they appear to be significantly more vulnerable under certain circumstances. Studies of large samples of randomly selected adults in the American population find that general religiosity promotes selective intolerance rather than universal acceptance (Rowatt, LaBouff, Johnson, Froese, & Tsang, 2009). True tolerance and lack of prejudice are only observed experimentally in agnostic individuals (Hall et. al, 2010; Altemeyer et. al, 1992).

**Implicit Association Test**

A large portion of the data gathered by social scientists is self-report data. While this data has proven to be very valuable, asking people to describe themselves can be problematic because they are often unwilling or unable to accurately report self-reflective information. This is especially true with socially sensitive topics, as the research on SDR and religiosity illustrates. In order to overcome the limitations of explicit attitude measures, a host of implicit measures have been honed and tested. One of the most widely used is known as the implicit association test (IAT) (Greenwald, McGhee, & Schwartz, 1998). In an IAT, opposing objects, concepts, categories, etc. are paired with positive and negative adjectives in a compatible condition, and then paired with adjectives of the opposite spectrum during an incompatible condition. If participant’s reaction times are statistically different in one condition compared to the other on average, this is indicative of implicit bias. The IAT is often used to measure implicit attitudes, but the method is not limited to attitude alone.
IAT measures have been shown to be reasonably insensitive to procedural variability such as time intervals between stimuli or overall number of trials. They have also demonstrated a robust ability to resist “faking” - particularly on a sexual identity IAT (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). This is important because, while Greenwald et al. (2009, p.28) found that self-report measures had somewhat greater predictive validity (r=.361) than IAT measures (r=.274) generally, the “predictive validity of self-report measures [but not of IAT measures] was sharply reduced when research topics were socially sensitive.” For example, the predictive validity of the IAT for race and other intergroup domains was significantly higher than self-report measures. Interestingly, the predictive validity of the IAT for gender/sexual orientation was somewhat lower than self-report measures in Greenwald et al.’s (2009) meta-analysis, but there seems to be good reason to think that the IAT’s accuracy in predicting behavior will soon supersede self-report measures as the social acceptance of sexual identity prejudice decreases. For this reason, it seems that generational differences (i.e. age) may be an important factor to take into account when attempting to generalize and predict future behavior based on sexual identity IAT measures versus self-report measures. It is clear from Greenwald et al.’s (2009) meta-analysis that predictive validity varies widely across domains. In some cases (e.g. socially sensitive topics) implicit measures are better predictors of behavior, and in other cases explicit measures are more reliable. Thus, explicit and implicit measures are not equally interchangeable across domains. Rather, they each possess a significant degree of mutual incremental validity in different domains. The more implicit and explicit measures are inter-correlated, the higher their individual predictive validity. Thus, it is usually better to use implicit and explicit measures together whenever possible for maximal accuracy. Each method provides “a gain in predictive validity relative to using the other alone” (Greenwald et al., 2009, p.32).
Several objections have been made to the IAT - many of them questioning what is actually being measured. Arguments that the IAT is measuring attitudes that are partially under conscious control are supported by experiments revealing a significant difference between average response times on a public IAT and the same IAT given in private (Boysen, Vogel, & Madon, 2006). At face value, this objection seems to damage the credibility of the IAT as an implicit measure. However, in a follow up experiment Boysen et al. (2006) exposed one of two groups of IAT participants to a “bogus pipeline” condition in which they believed experimenters had access to their true attitudes via physiological measurements. Under these conditions, there were no significant differences between the control group and the bogus pipeline group. Therefore, although the IAT may be somewhat malleable according to situational variables, these variations do not appear to be under the conscious control of the participant.

Another objection is that the IAT may simply be measuring differences in familiarity rather than reflecting any true implicit bias (Dasgupta, McGhee, Greenwald, & Banaji, 2000). For example, it may be that people are just more familiar with white American faces than black American faces. This familiarity explanation was tested using a race IAT with equally unfamiliar stimuli and strict statistical controls on familiarity; and the results indicated that the IAT is not significantly affected by stimulus familiarity (Dasgupta et al., 2000). This internal robustness was true for multiple kinds of stimuli, supporting the internal validity of the IAT for both images and words (Dasgupta, Greenwald, & Banaji, 2003). These results are clear evidence that the IAT is measuring implicit evaluations, not merely familiarity. Finally, evidence in support of an emotional component has surfaced with findings that differential amygdala response is significantly related to IAT reaction time differences between compatible and incompatible conditions (Dasgupta et al., 2003). This further supports the notion that the IAT is truly
measuring implicit attitudes, and that those attitudes are comprised in part by affective evaluations.

**Priming**

While correlational data can provide a powerful demonstration of relationships, a common error is to mistake correlation for causation. The data so far demonstrate that religion and certain types of prejudice are correlated, but it would be a mistake to conclude that religion causes prejudice on this basis. It may be that prejudiced people are more likely to be religious. One way to parse causation scientifically is to induce an experimental manipulation; and one way to do that is to prime participants. Priming is any procedure that brings a specific concept or group of concepts to mind; and it is valuable in experimental terms because recently primed concepts are more likely to be used during the interpretation of novel stimuli (Kunda, 1999). In other words, priming is “information activation,” and because the information has been recently activated in mind, it is more accessible during subsequent tasks (Bless, Fiedler, & Strack, 2004, p38-39). The temporal ordering of priming allows one to infer causation for any differing effects on subsequent tasks in a well-controlled experiment. Priming has a multitude of experimentally demonstrated effects including reduced response latency for similar words presented in succession (as opposed to dissimilar words), as well as object evaluation differences that are affected by priming diametrically opposed moods (Bless et al., 2004; Kunda, 1999).

When specifically Christian religious concepts are subliminally primed, both covert and overt racism are increased (Johnson, Rowatt, & LaBouff, 2010). And when religious believers are primed with violent scripture or scripture in which God condones violence, they become significantly more aggressive (Bushman, Ridge, Das, Key, & Busath, 2007). In addition, the priming of religious concepts causes people who have donated to a religious organization in the
past to significantly increase their active punishment (i.e. their retributive impulse) toward an unfair behavior (McKay, Efferson, Whitehouse, and Fehr, 2011). Looking at things from the opposite angle, Vilaythong, Lindner, and Nosek (2010) primed participants with two versions of the golden rule - one from Buddha and one from Jesus - prior to completing a sexual identity IAT and an explicit measure of attitudes toward homosexuality. A natural hypothesis would seem to be that if priming violent scripture increases aggression, then priming benevolent scripture should increase altruism. Contrary to this hypothesis, Vilaythong et al. (2010, p.502-503) found that priming the golden rule had no significant altruistic effects on implicit attitudes (i.e. “Golden Rule priming had no effect when communicated by one’s own religious leader”). Interestingly, Christians (but not Buddhists) exhibited a “reactance effect” to golden rule statements from a religious out-group leader (i.e. Buddha) that caused them to be significantly more biased against homosexuals on explicit measures.

**Neural Correlates**

While the method of the IAT has been accumulating diverse research results consistently since it was introduced by Greenwald et al. (1998), very little research has looked for any neurocognitive correlates of the behavioral differences it exposes. Neuroscientific methods seem uniquely able to shed light on the brain processes that are occurring during an IAT, and also to highlight any differences between conditions. Because cognition happens very rapidly, electroencephalography’s (EEG) ability to measure brain processes very accurately in time seems especially valuable. Despite the paucity of neuroscientific research, a recent exploratory study comprehensively examined specific neural correlates during an IAT. Williams and Themanson (2010) examined event-related potentials (ERPs) during a sexual identity IAT in which images of straight couples and positive adjectives were paired, and images of gay couples
and negative adjectives were paired in the compatible condition. They attempted to identify a host of components present within the ERPs including an N1 (selective attention), a P2 (perceptual processing), an N2 (response conflict - conflict between the options), an N400 (semantic congruency), and Late Positivity Potentials (LPPs) (enhanced emotional processing). Their results illuminated significant N400 differences between compatibility conditions for word stimuli, indicating greater semantic incongruence in the incompatible condition. Previous research has identified the N400 (i.e. an increase in negative voltage peaking around 400 milliseconds) as an effect associated with inconsistent meaning analysis in language comprehension (Van Berkum, 2008). Further, this negative ERP deflection is not merely present in simple language tasks, but is reflected in complex moral judgments which are, counter intuitively, based largely on automatic intuitions (Van Berkum, Holleman, Nieuwland, Otten, & Murre, 2009; Haidt, 2001).

A second ERP component implicated in complex moral judgments is the Late Positivity Potential. Larger LPPs have been specifically linked to “evaluatively inconsistent stimuli” (e.g. a negative word among a list of positive words) and they reflect enhanced processing (Cacioppo, Crites, Jr., Gardner, & Berntson, 1994). LPP effects have also been observed to be stronger (i.e. more positivity) for negative than positive stimuli, although both valences have significantly heightened LPPs in comparison to neutral stimuli (Ito, Larsen, Smith, & Cacioppo, 1998). These findings are consistent with negativity bias generally. It is an evolutionary advantage to pay more attention to negative stimuli than positive stimuli. If you miss some honeycomb it is not nearly as detrimental to the survival of your genes as failing to notice a stalking tiger. LPP effects are observed beginning around 500 milliseconds during rapid but morally complex value judgments because participants are viewing “strongly value-inconsistent statements as potentially aversive
stimuli that warranted extra attention” (Van Berkum et al., 2009). It is also worth noting that positive and negative motivational systems have sometimes been found to operate independently - something known as “uncoupled activation” (Ito et al., 1998, p.887). It seems probable that people would experience this kind of strong ambivalence (i.e. higher levels of simultaneous positive and negative affect) especially with regard to socially sensitive topics for which there is dissonance between their private attitudes and the public milieu (e.g. racism in a society promoting egalitarianism and equality).

Williams & Themanson (2010) also discovered significantly more late positivity (i.e. increased LPP) in the compatible condition compared to the incompatible condition. This was attributed to findings that successive stimuli of the same affective valence can have additive effects relative to stimuli of opposing valences counteracting each other. Interestingly, the relationship of ERP amplitude and reaction time (RT) in Williams and Themanson’s (2010) research reflected a curvilinear relationship such that participants with low levels of bias had amplitudes that increased as RT differences increased; but as RTs continued to become more disparate for moderate to strongly biased participants, LPP amplitudes decreased. It is unclear if this particular finding is due to a previously unknown effect or simply a small sample size (i.e. only 20 participants analyzed). Overall, Williams et al.’s results indicate that both semantic and affective processing contribute to behavioral outcomes in an IAT, and that “the cognitive processes involved in a typical IAT task are multifaceted.” (p8)

**Need for Cognitive Closure**

Research has revealed a recurring dispositional foundation underlying prejudice. This personality characteristic emerges in psychological theorizing as early as the 1950s, but has most recently been designated *need for closure* (NFC). Individuals vary widely in their level of NFC.
Those with high NFC exhibit a strong desire for a definitive answer to any particular question and, generally, are very uncomfortable with ambiguity (Roets & Van Hiel, 2011). Two elements have been articulated as the main components of high NFC. Urgency is the tendency to seize the initial information to which one is exposed; and permanence is the immediately following tendency to freeze that information in mind and refuse to alter it in spite of any new, more complete information. These two tendencies lead to essentializing (i.e. reducing complexity and labeling according to essence) as a general framework with which to view the world; and that, in turn, leads to heightened prejudice. High NFC has been strongly linked to explicit and implicit prejudice in a variety of domains (Roets et al., 2011). It has also been linked to religious fundamentalism to the extent that experimental results yield conclusive evidence that NFC is a partial mediator of increased prejudice among highly fundamentalist individuals (Brandt & Reyna, 2010).

**Summary and Hypotheses**

An abundance of research using the IAT to measure many types of implicit prejudice, including sexual identity prejudice, has been completed since its inception; and numerous studies undertaken in the past half-century have firmly cemented the correlation between religiosity and prejudice. Far fewer studies, however, have introduced an experimental manipulation in an attempt to uncover the differentially causal elements of prejudice among the highly religious. Further, there is a paucity of research utilizing brain imaging methods in combination with the IAT. The author was unable to find a single study that combined ERP methods, IAT measures, and personality measures to examine the relationship between implicit sexual identity prejudice and religiosity. This experiment endeavored to utilize all of these methods in combination in
order to paint a more complete picture, as well as to introduce a manipulation related to the usefulness of religion in everyday life.

It was hypothesized that participant IAT response times would be significantly slower in the incompatible condition (i.e. homosexual picture/positive adjective pairings) relative to the compatible condition (i.e. homosexual picture/negative adjective pairings). This prediction is consistent with the IAT research literature previously reviewed as well as the findings of Williams and Themanson (2010) and Rowatt et al. (2006). It was also hypothesized that participants with higher levels of religiosity (i.e. fundamentalism) would exhibit much more bias than those who were less religious. Reciprocally, participants with high levels of quest (i.e. agnosticism) were predicted to exhibit much less bias. Further the author predicted that priming individuals with Bible verses emphasizing God’s love (i.e. altruistic verses) would have either no effect (Vilaythong, Nosek, & Lindner, 2010) or would cause participants to respond even more slowly in the incompatible condition due to the tendency of religiosity to inspire increased tolerance toward in-group members while reciprocally increasing intolerance toward out-group members (Hall, Matz, & Wood, 2010).

The semi-exploratory nature of the manipulation in this experiment meant that hypothesizing about the priming of persecutory scripture (i.e. Bible verses condemning homosexuals) was somewhat more difficult. On one hand, it seemed likely that exposure to explicitly hateful verses could cause the majority of participants to recoil and develop a temporary egalitarian goal promoting increased tolerance toward the specific group mentioned. This heightened explicit fairness could bleed over substantially into states of mind and brain, potentially affecting implicit responses. On the other hand, exposure to blatant intolerance may increase the cognitive load of participants leading them to become more distracted when
confronted with the target group and, thus, respond even more slowly. It was predicted that religious fundamentalism, quest, and explicit attitude toward homosexuals would mediate differences between verse conditions in the same manner as compatibility conditions.

Hypotheses regarding neurocognitive correlates were complex, but generally the author predicted that the findings of Williams and Themanson (2010) (e.g. that significantly slower response to the incompatible condition would exhibit both N400 effects and Late Positivity Potentials) would be supported. Since LPP effects are correlated with heightened emotion, the author further predicted that participants with lower fundamentalism would exhibit greater LPP effects between altruistic and persecutory conditions. The reasoning supporting this prediction was that religious fundamentalism should act as an empathy buffer, allowing highly fundamentalist individuals to automatically demonize/dehumanize homosexuals and, thus, experience less negative emotion when exposed to verses demanding theocratic, violent, retributive punishment on the basis of sexual identity.

Materials and Methods

Following Institutional Review Board approval, 45 undergraduate students at a private liberal arts college (11 male and 34 female, mean age: 19.4) participated in return for course credit. Each participant was fitted with a 32 electrode EEG cap connected to a Biosemi Active Two recording system. Labview version 8.5.1 (National Instruments, Austin, Texas) was utilized to run the Biosemi recording software, ActiView, for all EEG data acquisition. Additionally, electrodes were placed beside and below the left eye in order to monitor both lateral and horizontal eye movements, and two reference electrodes were placed on the mastoid bones behind the ears. Participants were instructed to minimize eye movements and to read everything carefully. They then completed a version of the IAT in which the pairing of images of
heterosexual couples and negative adjectives (inadequate, unloveable, undesirable, inferior, disgusting, repulsive, worthless, foolish) as well as the pairing of images of homosexual couples and positive adjectives (worthy, loveable, admirable, valuable, trustworthy, successful, bright, excellent) constituted the incompatible condition. The compatible condition paired heterosexual couple images and positive adjectives, as well as homosexual couple images and negative adjectives. The IAT was created and presented using PsyScope X Build 53. Anthony Greenwald’s self-esteem IAT software template (Greenwald, 2006) was used as the basis for creating the IAT for this experiment (See also Borton, Oakes, Van Wyk, & Zink, 2007).

The IAT began with a familiarization phase of twenty four trials in which participants were directed to press the “d” key on a computer keyboard for positive adjectives and the “k” key for negative adjectives. Immediately following the first familiarization phase, a subsequent 24-trial block directed participants to press the “d” and “k” keys for images of heterosexual and homosexual couples respectively. After the two familiarization phases, participants read a series of four Bible verses and marked their level of agreement with each one on a five point Likert-type scale. Each participant was, in actuality, exposed to eight verses - four involving themes of God’s love (i.e. altruistic verses), and four involving themes of God’s judgment and violent, retributive punishment toward homosexuals (i.e. persecutory verses) (See Appendix A for a complete list of verses). Both sets of scripture contained two verses from the Old Testament and two verses from the New Testament. Participants completed two pairs of 64-trial blocks. Each pair of blocks contained one 64-trial set of compatibly arranged stimuli (i.e. compatible pictures and words) and one set of incompatibly arranged stimuli (i.e. incompatible pictures and words). After the first pair of blocks, participants were presented with the opposing four scriptural verses, and then they completed the remaining two blocks (see Fig. 1).
Fig. 1

Implicit Association Test Compatible and Incompatible Screenshots

Compatible Condition

PRESS 'd' FOR positive
or
Heterosexual Pictures

PRESS 'k' FOR negative
or
Homosexual Pictures

Incompatible Condition

PRESS 'd' FOR positive
or
Homosexual Pictures

PRESS 'k' FOR negative
or
Heterosexual Pictures
Order was counterbalanced by randomly assigning participants equally to one of the four orders listed below:

<table>
<thead>
<tr>
<th>Key</th>
<th>Order</th>
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<tbody>
<tr>
<td>A = Altruistic Verses</td>
<td>Order 1: ACI-PCI</td>
</tr>
<tr>
<td>P = Persecutory Verses</td>
<td>Order 2: AIC-PIC</td>
</tr>
<tr>
<td>C = Compatible Condition</td>
<td>Order 3: PCI-ACI</td>
</tr>
<tr>
<td>I = Incompatible Condition</td>
<td>Order 4: PIC-AIC</td>
</tr>
</tbody>
</table>

After the IAT was completed, all electrodes and the EEG cap were removed and participants changed location to a computer in an adjacent room where a series of three surveys measuring explicit attitudes toward homosexuality (12 statements), religious fundamentalism (20 statements), and quest (16 statements) (Altemeyer, 2003; Altemeyer & Hunsberger, 1992) were completed. The survey measure for fundamentalism is a broad measure dealing with a wide range of topics, and it is designed to be non-specific to any particular religion with the exception of three statements that explicitly mention Satan. An example of a pro-trait survey item on the fundamentalism scale is, “God has given mankind a complete, unfailing guide to happiness and salvation, which must be totally followed.” The questing survey is a more specific measure designed to assess a seeking or searching perspective. As mentioned previously, it has been argued that quest is most accurately understood as a measure of agnosticism. It is interesting to note that self-reports of church attendance correlate positively with fundamentalism ($r = .65$) and negatively with quest ($r = -.56$) (Altemeyer et al., 1992). An example of a pro-trait item on the quest scale is, “It might be said that I value my religious doubts and uncertainties.” The fundamentalism scale and the quest scale are, generally, highly negatively correlated ($r = -.79$). The attitudes toward homosexuals scale is a straightforward measure of explicit attitudes. An example of a pro-trait item on this scale is, “I won’t associate with known homosexuals if I can help it.”
All three of these survey measures contain roughly an equal number of pro-trait and con-trait items to avoid confounds and enhance accuracy; and factor analysis of all three measures demonstrates they are highly internally consistent and valid (Altemeyer et al., 1992). The three survey measures were counterbalanced among participants by randomly assigning all six possible orders. Labview version 11.0 was utilized to create a virtual instrument to administer the three surveys. Participants read each statement marked their level of agreement by positioning a slider on a Likert-style scale ranging from “Not at all” to “Very much.” These slider positions corresponded to numerical ratings ranging between -4 and 4, although the numerical ratings were not observable by participants. The experiment concluded with a debriefing form, including socio-demographic questions, and participants were given the opportunity to ask questions of their own and express concerns about the experiment prior to leaving.

**Data Processing and Analysis**

Mean reaction time scores were calculated for each participant for compatible (C) and incompatible (I) trials during both altruistic (A) and persecutory (P) verse conditions. Traditionally, IAT scores utilizing a paradigm with two consecutive C conditions and two consecutive I conditions have been evaluated by a “conventional algorithm” comparing mean differences between only the latter C and I conditions (Greenwald, Nosek, & Banaji, 2003, p.197). However, a more accurate and scientifically robust scoring procedure for calculating something called a $D$ score has been identified (Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Lane, Banaji, Nosek, & Greenwald, 2007; Greenwald, Nosek, & Banaji, 2003). Calculating $D$ scores essentially involves excluding extraordinarily slow and fast outlying trials and then dividing the remaining mean differences between the first and second pair of C and I conditions by an inclusive standard deviation. In other words, all of the compatibility data is used
rather than just the second block of trials. This method provides many benefits including the following: incorrect trials are effectively included, internal consistency is maintained, order effects are minimized, individual differences are better controlled, the effects of recently completed IATs are better controlled, and legitimate correlations between implicit and explicit measures are maximized. In short, $D$ scores are superior to conventional scoring procedures when multiple I and C trial blocks are present. This experiment was complicated by the fact that a large number of trials were needed to obtain enough data for statistically robust ERP comparisons between conditions. For this reason, only one block of C and I trials was completed per verse condition, but the blocks were increased to 64 trials each. As a result, mean differences were relied upon for reaction time ANOVAs and graphs. However, $D$ scores were calculated for C and I across A and P conditions and subsequently utilized in all correlation tests.

EEG data files for all participants were processed using an open source graphical user interface for MATLAB called EEGLab (Delorme & Makeig, 2004). An additional EEGLab plugin called ERPlab (Lopez-Calderon & Luck, 2011) was also utilized during data processing and analysis. Each participant’s data was imported into EEGLab and all 32 channels, as well as both eye movement channels, were selected for processing. A band pass filter was applied to the data, filtering out voltage waves below .01 Hz and above 30 Hz. Each participant’s data were then organized into bins according to verse condition and compatibility condition, and they were further separated into word and picture stimuli. This was possible because of event codes that had been previously assigned to each condition in PsyScope that were embedded in the data as the participant completed the experiment. Epochs of -200ms to 850ms were extracted surrounding all relevant event codes, creating event-related potentials (ERPs). Data was then processed using independent components analysis (ICA) in order to enable artifact correction.
Based on the ICA results, eye movement artifacts were corrected for all participants in which they were isolated effectively. This turned out to be the majority of participants. Data were analyzed using the EEGlab study framework as well as ERPlab’s grand averaging and waveform utilities. Statistical analyses including t-tests and repeated measures ANOVAs were conducted using permutation tests within EEGlab study framework. Significance was set at the .05 level, and a false discovery rate (FDR) correction was applied to correct for multiple comparisons. Studies and grand average ERP waveforms were set up to isolate pictures and words and compare them across conditions according to verse, compatibility, and survey scores. The separation of word and picture stimuli was important because the brain’s response to them is generally quite different (Williams et al., 2010).

Quantitative data from the three survey measures were compiled for each participant. Con-trait items were converted to their reciprocal sign, and all items (i.e. both pro-trait and con-trait) were added together to obtain each participant’s total score for religious fundamentalism, quest, and explicit attitudes toward homosexuality. Participants were ordered according to rank and divided in half at the median score for each of the three survey measures. In this manner, groups of high and low fundamentalism, high and low quest, and high and low explicitly prejudicial attitudes toward homosexuals were formed.

A variety of statistical tests including t-tests, between-subjects Analyses of Variance (ANOVAs), and repeated-measures ANOVAs were run using reaction time data and survey measures, as well as for EEG data as described above. Correlations between survey measures and D scores for both the A and P verse conditions were run, although the p-values for these correlations were not corrected for the total number of correlations calculated.
Results

Overall reaction time differences between verse conditions (A and P) for all participants combined were not significant (t(44)=−1.0175, p=0.31), (F(1,44)=0.19, p=0.73). However, overall reaction time differences between compatibility conditions (C and I ) for both the A verse condition (t(44)=−6.2754, p<0.001) and the P verse condition (t(44)=−8.0604, p<0.001) were highly significant (F(1,44)=76.75, p<0.001) and in the predicted direction. So there was a main effect of compatibility but not verse, and there were no significant interactions between verse and compatibility overall (F(1,44)=0.605, p=0.44). In other words, participants all together were much slower to pair positive adjectives with images of homosexual couples and negative adjectives with images of heterosexual couples (See Fig. 2).

Distinct differences began to emerge when participants were separated into high and low groups according to their scores on the survey measures. As previously hypothesized, religious fundamentalism (RF) was positively correlated with slower D scores (i.e. enhanced implicit bias) in both A (r=0.41, t(43)=2.9429, p=0.005) and P (r=0.41, t(43)=2.9375, p=0.005) verse conditions; and the C vs I mean differences between RF groups were significant (F(1,43)=15.48, p<0.001) (See Fig. 3). Otherwise stated, participants who were more highly fundamentalist (HRF) exhibited much greater reaction time disparity between C and I conditions than low fundamentalist participants (LRF), which is to say that HRF participants were much slower to respond in the incompatible condition generally than LRF participants. Additionally, a differential response to verse conditions between HRF and LRF participants was observed.
Average reaction times for HRF participants were faster in the P verse condition than in the A verse condition; whereas average reaction times for LRF participants were faster in the A verse condition.
verse condition than in the P verse condition, although this was primarily true for LRF participants in the C condition. These opposing differences between HRF and LRF groups and verse condition was significant (F(1,43)=4.55, p=0.04). So, A and P verses had opposite effects on HRF and LRF participants. For HRF participants, P verses decreased response time; whereas, the P verse condition increased or maintained response time for LRF participants. It appears that blatant persecutory scripture has a much different effect on HRF participants than it does on LRF participants.

At first glance one might explain these effects of verse condition by asserting that, apparently, P verses decrease implicit bias for HRF participants and increase implicit bias for LRF participants. This explanation, however, does not account for the differential movement of reaction times in both C and I conditions across verse conditions. As human beings evolved, they developed an attentional bias that favors negative information (i.e. a negativity bias) (e.g. Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001). The importance of this bias for survival is reduced in modern society due to the environmental changes wrought by civilization, but it is still observably expressed in the allocation of cognitive resources (Taylor, 1991). Basically, more attentional resources are devoted to negative stimuli than positive or neutral stimuli (Ito, Larsen, Smith, & Cacioppo, 1998). Additionally, studies examining stereotype threat have repeatedly found that when targets of negative stereotypes are reminded of those stereotypes, they become more vigilant in their efforts to avoid any confirmatory behaviors (Schmader, 2010). This additional vigilance has the side-effect of increasing cognitive load and reducing working memory capacity. Further, those who are most affected by stereotype threat are individuals who have the deepest concerns about negative stereotypes and, therefore, put forth the most effort toward not embodying them.
It seems possible that participants in the current study who held the least prejudicial views toward homosexual couples could be most affected by stereotype threat. Otherwise stated, participants who cared most about not being biased against homosexual couples (presumably
LRF participants) may have had their working memory during the IAT partially consumed by their own vigilance against prejudice in a way that HRF participants did not.

A more plausible explanation for the differential effects of persecutory scripture between HRF and LRF participants is that P verses have a fundamentally different effect on one group than they do on the other. One possibility is that, in the HRF group, sexual identity stereotypes and biases are confirmed - even justified - by the persecutory verses enabling participants to respond faster to both C and I trial blocks in the P verse condition because the stimuli are rendered less negative and, thus, require reduced processing resources. Further, persecutory verses may increase the certainty of HRF participants regarding the righteousness of their sexual identity bias when they are exposed to scripture documenting God’s retributive judgment of homosexuals. LRF participants, as previously mentioned, may experience persecutory verses as violating explicit egalitarian values. This may have the effect of increasing the negative valence of all stimuli in the P verse condition relative to the A verse condition, resulting in increased cognitive load and, therefore, slower responses for both C and I conditions. Additionally, LRF participants may experience heightened sensitivity to their own implicit sexual identity biases and redouble their efforts to avoid being biased. The HRF and LRF patterns displayed in Fig. 3 seem to support these conclusions.

It is notable that, in support of their ability to capture the opposing ends of the spectrum of religiosity (or lack thereof), Quest and RF were negatively correlated (r=-0.87, t(43)=-11.56, p<0.001 ). Quest itself was negatively correlated with D scores in both A (r=-0.42, t(43)=-3.0616, p=0.003) and P (r=-0.35, t(43)=-2.4425, p=.02) verse conditions; and mean reaction time differences among high quest (HQ) participants and low quest (LQ) participants were significant (F(1,43)=8.946, p=.004)(Fig. 4). So, as Quest increased, reaction times (i.e. implicit bias)
decreased. The opposing effects of verse seen in HRF versus LRF groups were also observed among HQ and LQ groups, although here they occurred in reverse. HQ participants expressed increased average reaction times in the P verse condition relative to the A verse condition, while
LQ participants expressed decreased reaction times in the P verse condition relative to the A verse condition (F(1,43)=7.03, p=.01). In sum, Quest results were almost a perfect inverse mirror image of RF results. This is unsurprising since Quest and RF are so highly negatively correlated (i.e. participants who are high in RF are reciprocally low in Quest and vice versa). These data make sense particularly if, as argued earlier, Quest is a measure of agnosticism and RF a measure of the strength of a person’s religious faith.

Explicit homosexual prejudice (EHP) was positively correlated with RF (r= .66, t(43)=5.7209, p<0.001) and negatively correlated with Quest (r=-.65, t(43)=-5.5581, p<.001). Interestingly, EHP was also positively correlated with D scores in the A verse condition (r=0.37, t(43)=2.6245, p=0.01), but not in the P verse condition (r=0.07, t(43)=0.4605, p=0.65). Looking at Fig. 5, it appears this is possibly due to increased response time latency for participants with low homosexual prejudice (LHP) in the PI condition in combination with reduced response time latency for participants with high homosexual prejudice (HHP) in the PI condition. These two opposite effects appear to have the net result of bringing the means for both groups closer together and, thus, canceling each other out. Mean reaction time differences between HHP and LHP groups for C versus I conditions overall were significant (F(1,43)=4.881, p=.03). Further, verse condition differences between HHP and LHP groups were also significant (F(1,43)=6.571, p=.01), and there was an interaction between verse condition, compatibility condition, and EHP (F(1,43)=4.351, p=.043). Fig. 5 demonstrates that the results for HHP and LHP groups bears a striking similarity to the results for HRF and LRF participants (i.e. Fig 3). This is not surprising in light of the positive correlation between RF and EHP, indicating that many of the participants in the HRF group are also in the HHP group and vice versa.
The differences between the A verse condition and the P verse condition for LHP and HHP participants is possibly a result of the increased cognitive load and stereotype threat mentioned previously. In other words, the least explicitly biased participants seem to have really struggled with the hateful retribution present in the persecutory verses in a way that HHP participants did not. This appears to have maximized the negativity of the I stimuli in the P verse Fig. 5
condition, increasing response times for LHP participants. This increase, combined with the corresponding decrease of average reaction times for more highly prejudiced participants (HHP) was enough to even the statistical playing field in the P verse condition, resulting in the correlation between EHP and the P verse condition being non-significant. Alternatively, perhaps blatant prejudice or the notion of supernaturally endorsed violence against homosexual value-violators is overtly problematic in a way that the (perhaps more insidious) passive prejudice evoked via the A verse condition is not. Related to this is the possibility that participant exposure to blatant Biblically endorsed violence undermines their explicit and implicit bias which may engage their empathy to a greater degree. However, if this were true one would expect to see significant mean response time reduction between C and I conditions across verse condition for at least one, if not both groups of participants. This did not occur. Further, one would expect only the I condition mean response time to decrease - not the reduction in both C and I response times observed in HHP participants. Additionally, if greater empathy was the result of the P verse condition across all participants, an equal or even larger decrease in the response times of LHP participants in the PI condition should have been apparent. After all, the LHP participants were much more explicitly sympathetic toward homosexual couples than HHP participants. The fact that LHP responses in the PI condition increased so dramatically is further support for the cognitive load explanation regarding LHP participants, and the decreased negativity explanation for HHP participants.

A two-within/one-between subjects ANOVA revealed no main effect of order \(F(1,43)=0.191, p=.664\) on mean reaction times, and no interaction between order and compatibility \(F(1,43)=1.063, p=.31\). However, there was a two way interaction between order
and verse condition ($F(1,43)=18.236, p<.001$) and a three way interaction between verse condition, compatibility condition, and order ($F(1,43)=13.531, p<.001$). Fig. 5 displays these interactions, and it appears that participants who were exposed to the A verse condition prior to
the P verse condition (i.e. order 1 and order 2) were affected much differently than participants who were exposed to the P verse condition prior to the A verse condition (i.e. order 3 and order 4). One can observe in Fig. 5 that mean reaction times appear to decrease between A and P verse conditions for orders 1 and 2, while they appear to increase between A and P verse conditions (with the notable exception of the C condition in order 3) for orders 3 and 4.

It is important that these order effects are treated cautiously, since the statistical tests examining order - unlike all of the previous tests - separated participants into four groups, thereby reducing the sample size for each group to minimal levels. The differences between the first two orders and the second two do seem similar to the opposing differences observed between each of the high and low groups previously described (e.g. HRF vs LRF). But, since orders were randomly distributed and counterbalanced among all participants, it seems very unlikely that the vast majority of HRF participants, for example, received orders 1 and 2 while the majority of LRF participants received orders 3 and 4. In fact, a visual review of all participant data reveals that they were roughly equally distributed in terms of HRF and LRF among all four orders - a likely result of the initial random assignment. It seems equally unlikely that orders 1 and 2 somehow caused participant’s levels of RF, Quest, or EHP to increase when they completed post-experimental survey measures while orders 3 and 4 decreased them. After all, every participant was exposed to both altruistic and persecutory scripture prior to completing the survey measures - the only difference was which verses they were exposed to initially. For these reasons, a series of two-within/two-between subjects ANOVAs were calculated to separate order effects from verse and compatibility conditions, as well as from RF, Quest, and EHP. The interaction between RF and verse condition remained significant even when controlling for order (F(1,36)=8.242, p=0.006). This was also true for the interactions between compatibility and RF.
(F(1,36)=16.82, p<.001), compatibility and Quest (F(1,36)=8.902, p=.005), and compatibility and EHP (F(1,36)=4.769, p=.035), as well as for verse and Quest (F(1,36)=9.465, p=.003), and verse and EHP (F(1,36)=8.666, p=.006) interactions. Additionally, the three way interaction between verse, compatibility, and EHP retained significance (F(1,36)=10.979, p<.001). In sum, all significant interactions and relationships described thus far remained significant even when controlling for order effects.

It seems likely that exposure to persecutory scripture at the outset of the current study had a persistent impact on participants, and that participants who were initially exposed to altruistic verses did not experience this impact until later in the experiment. In other words, it does not seem unreasonable to think that once participants were exposed to scripture condemning homosexuality and declaring homosexuals “shall surely be put to death” that these especially salient stimuli might remain in mind and alter responses to any subsequent stimuli. The fact that order effects were significant is a testament to the power of the scriptural manipulation in the current study. It would, in fact, be surprising if order had not had some significant impact on participants. However, the robustness of statistical significance among all of the other interactions, even when the variance explained by order was separated, is powerful evidence that those results are not attributable to order effects.

ERP scalp plots of all 43 participants separating the two verse conditions and the two compatibility conditions did not display any overall significant differences or interactions when the entire epoch (i.e. 100ms to 850ms) was averaged (Fig. 7). However, the scalp plot displaying word stimuli (Fig. 7b) did indicate higher overall activation in the PI condition relative to the other three (i.e. PC, AC, or AI). It is worth noting that statistical significance in ERP data can be murky territory since the correction applied for multiple tests (i.e. false discovery rate) is semi-
Fig. 7

Compatibility and Verse Overall

a. Picture Stimuli 100ms - 850ms

b. Word Stimuli 100ms - 850ms
dependent upon the size of the window of time chosen to analyze. Additionally, it can be very informative to observe waveform differences which may not rise to the level of statistical significance due to the level of variability in the data.

When participants were split into high and low RF groups, several striking differences emerged. The most robust of these differences was a much higher positivity for the picture stimuli of LRF participants than HRF participants in the AC condition, even when the entire epoch (i.e. 100ms - 850ms) was averaged. Fig. 8 displays a scalp plot of these results, and it is evident that electrodes in occipital, parietal, and central regions are significantly different, but also that frontal electrodes are significantly different. This finding of frontal activity in addition to activity in other areas of the brain is supported by other research indicating that the IAT engages more than just semantic priming, since semantic priming does not generally engage frontal brain areas (O’Toole & Barnes-Holmes, 2009). Further, this indication of differential frontal electrode activation is evidence that the verse manipulation in the current experiment was also engaging more than simple semantic priming. It is evident from the scalp plot in Fig. 8 that LRF participants exhibited more positivity generally than HRF participants.

Fig. 9 displays the four midline electrodes (chosen for their common use in ERP literature) of the picture stimuli for HRF and LRF participants in the AC condition. It is very apparent that LRF participants have much higher positivity than HRF participants for almost the entire duration of the epoch time period. This early and late positivity (LPP) is supported by previous research on moral judgments (Van Berkum et al., 2009), and is an indication of heightened emotion - likely as a result of strongly disagreeable ideas. It is difficult to say with certainty whether the emotion experienced by LRF participants was positive, negative, or
ambivalent. Taking the reaction time data into account, the most parsimonious explanation seems to be that LRF participants had great difficulty pairing pictures of homosexual couples and negative adjectives, especially after reading altruistic verses. This may be due to a reactance
effect of LRF participants to the scripture which is, almost certainly, laden with stereotypical implications regarding the attitudes Christian believers “should” have towards homosexuals. In other words, LRF participants emotionally reacted against sexual identity bias most profoundly when the religious priming was subtle in nature (i.e. the A verse condition) rather than obvious (i.e. the P verse condition). It is possible that reactance was due to a consciously held egalitarian mindset toward homosexual couples combined with an automatic abhorrence for religiously justified prejudice.
Alternatively, it is possible that the more negative waveform indicated by Fig. 9 for HRF participants is reflective of reduced emotional response to compatible stimuli which was reinforced by the A verse priming. For HRF participants, faith may act as a buffer against negative feelings regarding prejudice toward homosexuals (i.e. their prejudice is justified in their own mind); or, perhaps, HRF participants are altogether less attuned to sexual identity prejudice within themselves under more nuanced conditions (i.e. the AC verse condition). In all likelihood, both increased positivity for LRF participants, and reduced positivity for HRF participants contribute to the significant differences observed between these two groups.

When participants were separated into high implicit bias (HIB) and low implicit bias (LIB) groups according to $D$ scores, an interesting and significant difference between the two groups emerged in the PC condition for picture stimuli between 400 and 500 milliseconds (Fig. 10). Here, HIB participants had significantly higher positivity distributed across many electrodes in comparison to the LIB participants whose average waveforms were significantly more negative. Fig. 11 displays a waveform graph of the midline electrodes for the picture stimuli of HIB and LIB participants. It is evident here that HIB positivity / LIB negativity begins early (around 200ms) and continues until much later in the epoch (600 - 800ms). There are two explanations here that most adequately take account of the reaction time data. One explanation is that HIB positivity is indicative of ambivalent emotion as a result of uncoupled activation and/or negative emotion. This was possibly the result of heightened conscious awareness of the relationship between religiosity and prejudicial attitudes, as well as the underlying implications that experimenters held favorable and egalitarian attitudes toward homosexuals. In other words, it wasn’t obvious to HIB participants that the experiment was connecting religion to prejudice during the A verse condition, but it was obvious during the P verse condition. For HIB
participants, their own implicit attitudes were most in conflict with the experimental environment (i.e. one that was apparently favorable to homosexual couples) during the P verse condition. If this explanation is accurate, it would seem that both C and I conditions following exposure to P verses should reflect increased positivity, although it may be that biases are strong enough in the PI condition to overcome any conflict caused by the immediate social environment.
Alternatively, it may be that LIB negativity is reflective of an N400 effect. The negative waveform apparent in electrodes Pz, Fz, and Cz in Fig. 11 clearly peaks at approximately 400ms, and the time period of 400 to 500ms is where statistical significance prominently emerges between LIB and HIB participants in the PC condition (Fig. 10). An N400 here seems as plausible as the positivity effects previously mentioned. Such an effect is indicative of semantic incongruence of the stimuli for LIB participants relative to HIB participants. The presence of N400 differences indicates that, after reading P verses, LIB participants had problems pairing
compatible picture stimuli with their respective adjectives which were not present in HIB participants. A third explanation for the differences between HIB and LIB participants is that they are informed by both of the explanations described. LPP effects and N400 effects can co-occur (Van Berkum et al., 2009), and this seems very likely during a complex experience like the one on offer in the current experiment. It is worth noting that there were no significant ERP effects between groups when they were separated according to high and low levels of explicit homosexual prejudice. The most potent differences and meaningful measures in the current experiment were implicit.

Fig. 12 is a waveform graph displaying midline electrodes for high and low RF groups in the AC and PC conditions. Observations of Pz and Oz electrodes reveal that LRF participants exhibit more positivity in both conditions than HRF participants, although the AC condition for LRF participants clearly stands out in terms of heightened positivity. It is also worth observing that verse conditions had opposite effects for LRF participants than they did for HRF participants. In the case of LRF participants, the AC waveform (blue) is clearly much more positive than the PC waveform (green). But in the case of HRF participants, the PC waveform (red) is much more positive than the AC waveform (black). It is also very interesting to note that the differences in Fig. 13 - a waveform display of the picture stimuli for RF groups in the AI versus PI conditions - are reversed from those in Fig. 12. Here (i.e. in Fig. 13), the PI waveform for LRF participants (green) stands out as the most positive relative to the AI waveform (blue). For HRF participants the condition differences are less obvious, but it is still apparent that the AI waveform (black) and the PI waveform (red) have come together, and that the AI waveform is more positive than the PI waveform in many instances. These opposing differences are strong supporting evidence that fundamentally opposite things are happening in the minds of LRF
Fig. 12

Religious Fundamentalism Picture Stimuli Only - AC vs PC (Midline Electrodes)

Legend
HRF AC = High Religious Fundamentalism, Altruistic Verse, Compatible Condition
HRF PC = High Religious Fundamentalism, Persecutory Verse, Compatible Condition
LRF AC = Low Religious Fundamentalism, Altruistic Verse, Compatible Condition
LRF PC = Low Religious Fundamentalism, Persecutory Verse, Compatible Condition

versus HRF participants, and they are supportive of previously drawn conclusions for both ERP
and reaction time data.
Discussion

The totality of the data in the current experiment speaks clearly: the more unwavering a person’s religious beliefs (i.e. the less doubt they have), the more implicit bias they exhibit toward homosexuals. That is, religious fundamentalism and prejudice co-occur and co-vary. In addition, persecutory verses seem to make the biases built into highly fundamentalist individuals more concrete and justified, reducing the cognitive resources required for them to make bias-
related decisions and enhancing the ease with which their intuitive prejudice emerges. Reciprocally, the link between religiosity and prejudice against homosexuals is strong in the minds of individuals who are not very religious. This link seems to make those individuals especially sensitive to the subtle bias present within altruistic verses as a result of their association with the blatant prejudice endorsed in many sectors of Christianity. This sensitivity to bias is readily observable in the brains of LRF individuals compared to HRF individuals. So, a conscious egalitarian mindset has a meaningful effect on implicit attitudes. Unsurprisingly, scripture has fundamentally different effects on individuals who believe it to be true than it does on individuals who question its veracity; and these differential effects deeply impact the manifestation of bias among HRF individuals. Much like political propaganda strengthens prejudice against “enemies,” scriptural propaganda enhances prejudice against religious out-groups.

There is some good news in light of the relationship between high need for cognitive closure (NFC), religious fundamentalism, and prejudice. Individuals who are higher in NFC are also positively affected by contact with stereotype violating out-group members. In fact, intergroup contact reduces prejudice among high NFC individuals more profoundly than it does among low NFC individuals (Roets & Hiel, 2011). This is, undoubtedly, a useful prescription for seeking increased intergroup contact generally. However, NFC is only a part of the explanation for the relationship between religious fundamentalism and prejudice. Future research will be needed to tease out all of the tenants of such a complicated relationship. Modifications to the current study could include selecting groups at the outset according to high and low levels of fundamentalism, inserting ERP markers during verse exposure, combining ERP and fMRI methods to enhance source localization, inserting a control IAT which does not have any
attached priming scripture, and separating verse conditions into two sittings but doubling the number of trial blocks in order to enable the calculation of $D$ scores for all conditions.

It is useful to note that average scores for participants in the current study on the explicit attitudes survey (29.6) and the religious fundamentalism survey (32.4) were dramatically lower than the original sample (55.7 and 87.8 respectively) (Altemeyer, 1992). In other words, participants in the current study were roughly two and a half times less fundamentalist than participants in the study in which the original survey measure was published. This may reflect changing attitudes toward homosexuals as a result of age, generational differences, or some other factor(s). However, it seems safe to conclude that the participants in the current study exhibited extremely modest levels of bias in relation to the broader population. Further support for modest effects is provided by the method used to sort participants into groups. This was done simply by ranking participants from high to low and dividing them in half. Such a method of division - especially when compared to the method of selecting groups at extreme ends and excluding more moderate participants - pulls means toward the center and reduces the differences between groups. Modest levels of bias mean that the results indicated by the data are also quite modest, and that a more diverse sample of participants from the general population would very likely yield results with much greater disparity. The results from the current study are, almost certainly, attenuated in comparison to the broader population.

It has been argued recently that religion is best viewed in terms of the social benefits it provides, and also that it binds people together into moral communities (Graham & Haidt, 2010). While it may be true that religion enhances prosocial behavior within a particular religious group, it seems that the benefit of religiously enhanced intra-group cooperation carries with it an enhanced cost of inter-group prejudice. Are we really better people if our dogma causes us to be
kinder to the people on our own team and simultaneously more cruel and judgmental toward everyone else? Higher levels of religious conviction make people more vulnerable to scriptural propaganda. The data of this experiment illuminate that religious belief enhances the ugly parts of human nature as a consequence of the certainty and group allegiance it encourages. Faith may make it easier to deal with existential anxiety and/or motivate us to help the members of our own team (especially when it is reputationally beneficial); but the certainty faith provides enhances our natural bias against other human beings and allows us to believe that our prejudice is righteous and justified. Rather than encouraging plurality and acceptance across all of humanity, faith enables us to more easily demonize and dehumanize others. The evolution of moral progress in recent history is comprised of humanity’s increasing ability to empathize with larger and larger groups of people - recognizing the capacities of those people to experience happiness and suffering as equivalent to their own. Contrary to the intuitions of many, faith stands in the way of continuing forward on our collective journey to overcome the prejudice within us.
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Appendix A

Persecutory Verses

"Thou shalt not lie with mankind, as with womankind: it is abomination" - Leviticus 18:22

"If a man also lie with mankind, as he lieth with a woman, both of them have committed an abomination: they shall surely be put to death; their blood shall be upon them." - Leviticus 20:13

"Do you not know that the unrighteous will not inherit the kingdom of God? Do not be deceived. Neither fornicators, nor idolaters, nor adulterers, nor homosexuals, nor sodomites, nor thieves, nor covetous, nor drunkards, nor revilers, nor extortioners will inherit the kingdom of God." - 1 Corinthians 6:9-10

"...the men also abandoned natural relations with women and were inflamed with lust for one another. Men committed shameful acts with other men, and received in themselves the due penalty for their error... Although they know God’s righteous decree that those who do such things deserve death, they not only continue to do these very things but also approve of those who practice them." - Romans 1:27,32

Altruistic Verses

"For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life." - John 3:16

“But God demonstrates his own love for us in this: While we were still sinners, Christ died for us.” - Romans 5:8

“But he was pierced for our transgressions, he was crushed for our iniquities; the punishment that brought us peace was upon him, and by his wounds we are healed.” - Isaiah 53:5

"Give thanks to the God of gods. His love endures forever." - Psalms 136:2