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THE EFFECT OF RELIGIOUS AND REFLECTIVE PRIMING ON COGNITIVE BIASES AND COGNITIVE STYLE

by

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THE EFFECT OF RELIGIOUS AND REFLECTIVE PRIMING
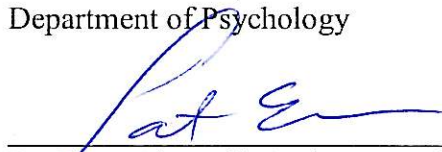
ON COGNITIVE BIASES AND COGNITIVE STYLE

by
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AN ABSTRACT OF THE THESIS OF

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Title: <u>The Effect of Religious and Reflective Priming on Cognitive Biases and Cognitive Style</u>

The effect of religious priming has been studied in relation to a number of variables, including prosocial behavior and racial prejudice. The effects of priming on cognitive domains, however, are relatively understudied. The present study examined the effects of religious priming, compared to reflective and neutral priming, on cognitive style and cognitive biases. Participants included students from the American University of Beirut who were randomly assigned to one of the three priming conditions. Priming was presented through the scrambled sentence task in which participants were required to rearrange words of a religious (e.g., pray), reflective (e.g., reason), or neutral (e.g., paper) content. Cognitive style was assessed through the Cognitive Reflection Task (CRT), a 3-item task measuring reflective thinking. The cognitive biases of interest included the conjunction fallacy and the base rate fallacy. Both are theoretically and empirically related to reflective thinking and were measured by a task containing one problem each. Results indicated that those undergoing the religious prime were significantly more likely to commit the conjunction fallacy compared to those in the reflective priming group. No such effect was found for the CRT and the base rate fallacy. Limitations and implications are discussed.

Keywords: Religious priming, conjunction fallacy, base rate fallacy, reflective thinking, reflective priming

CONTENTS

The Effect of Religious and Reflective Priming on Cognitive Biases and Cognitive Style

CHAPTER I

RELIGIOUS PRIMING

Priming refers to the implicit and temporary activation of concepts through subliminal or supraliminal means (Harrell, 2012). These concepts, in turn, influence performance on other tasks. An example of supraliminal priming includes exposing participants to words and images related to a specific concept or asking them to think about it. Conversely, a subliminal prime is any sensory stimulus presented below an individual's threshold of conscious perception (Loftus & Klinger, 1992). In the psychology of religion, earlier studies initially entailed correlating different aspects of religiosity with beliefs, attitudes, and behaviors of concern (Ritter & Preston, 2013). For example, religious belief has been previously positively related to agreeableness, conscientiousness (Saroglou, 2002) and overall mental health (Koenig, Mccullough, & Larson, 2001). Within the past decade, however, experimental approaches with religious priming have been introduced. A recent meta-analysis on religious priming has demonstrated its efficacy across a large number of studies (92) (Shariff, Willard, Andersen, & Norenzayan, 2015). The literature on the effects of religious priming spans both the behavioral and cognitive domain.

A. Effect of Religious Priming on Prosocial Behavior

A host of studies have shown that priming with religious words can be effective in changing subsequent responses on prosocial measures. Prosociality broadly refers to ethical, cooperative, or generous behaviors or attitudes (Sharrif, Willard, Andersen, & Norenzayan, 2015). That is, actions that benefit others at one's own personal expense (Norenzayan & Shariff, 2008). Having religious concepts implicitly activated led to more generous behavior

from participants in one-shot economic games, such as the dictator game (Shariff &

Norenzayan, 2007) (acting generously in this game entails leaving money for the next

participant), the prisoner's dilemma (Ahmed & Salas, 2011), and the public goods game

(games which similarly require distributing money to oneself and one's partner) (Ahmed &

Hammarstedt, 2011). In the above-mentioned studies, supraliminal priming included presenting

participants with scrambled words of religious content (e.g., 'is, the, *divine*, desert') with the

aim of rearranging these words in a grammatically-correct format. This effect persisted

regardless of religious belief, with both religious and nonreligious individuals responding to the

implicit religious prime in a similar way (Ahmed & Hammarstedt, 2011; Ahmed & Salas,

2011; Shariff & Norenzayan, 2007). In this instance, religious belief was measured through

assessing if participants believed in God and if they considered themselves a religious person.

Additionally, locals in Burkina Faso who were asked to discuss their religious beliefs in

semi-structured interviews performed more generously on an economic game than those

interviewed on neutral topics (Hadnes & Schumacher, 2012). Notably, however, religious

primes led to less generous responses with out-group members than with in-group members on

the dictator game (Shariff, 2009). Shariff & Norenzayan (2007) found that priming with secular

values similarly induced participants to act more prosocially compared to control primes. This

could imply that religious primes may be effective because they activate prosocial notions and

increase their salience.

Participants responded to threat with less hostility towards others when primed with

both religious and secular concepts (Schumann, McGregor, Nash, & Ross, 2014). Moreover,

participants were less likely to cheat if primed with religious words, using both subliminal and

supraliminal primes even when controlling for initial levels of religiosity (Randolph-Seng &

Nielsen, 2007). Furthermore, subliminal and supraliminal religious primes were effective in

increasing the number of charity pamphlets taken by participants before leaving the lab

(Pichon, Boccato, & Saroglou, 2007). Shariff and Norenzayan (2007) suggest that religious

priming works by activating notions of a supernatural watcher capable of monitoring behavior,

which subsequently influence responses. In contrast, Rand, Dreber, Haque, Kane, Nowak, &

Coakley (2013) have found that cooperation increased after religious priming but only in

religious individuals.

A study conducted by Aveyard (2014) with a Muslim population in the United Arab

Emirates, found religious priming, via the scramble sentence task, ineffective in reducing

cheating behavior. A follow up study, introducing the athan (Islamic call to prayer) as prime,

resulted in less cheating behavior. Aveyard attributes the negative result in the first study to the

frequency of religious stimuli in the Middle Eastern context. Western environments, in contrast,

are arguably more secularized and thus allow for a lower threshold of activation of religious

thought in participants.

Harrell (2012) found that religious primes with reward-related content (e.g., heaven,

salvation) were more effective in promoting prosociality than religious primes with non-reward

related content, particularly with strongly religious individuals. This may indicate that religious

primes carry within them implicit notions, such as reward, and that reward is concomitantly

activated with certain religious primes. A similarly nuanced study primed participants with

either 'God' notions (as a universal being) or 'religion' notions (suggesting group identity and

membership). Priming with the word 'religion' led to greater prosocial behavior towards in-

group members, whereas with the word 'God', the prosociality extended to outgroup members

(Preston & Ritter, 2013). The same effect was found when subliminal cues were employed.

Based on a total of twenty-five studies, Sharrif, Willard, Andersen, and Norenzayan (2015)

have concluded that religious priming encourages prosociality.

B. Effect of Religious Priming on Cognitive Processes

The effect of religious priming has similarly been examined on cognitive processes, specifically attribution of authorship and attention. An attribution of authorship occurs when a person reports a feeling that the self is the author or agent of an action. When subliminally primed with the word God, individuals with high religious belief were less likely to attribute ambiguous actions in a computer task to the self than those with control primes (Dijksterhuis, Preston, Wegner, & Aarts, 2008). Nonbelievers, however, do not perceive God as a plausible agent and so self-attribution was expectedly higher for this group.

With regards to attention, 'God' and 'devil' primes were shown to generate opposing attention shifts. For example, responding to targets placed above was quicker when participants had been previously primed with the concept God (since God is internally represented as upwards), regardless of religiosity (Chasteen, Burdzy, & Pratt, 2010). Similarly, devil related words induced quicker downward spatial attention, since 'devil' is spatially represented as downwards. This finding indicates that the metaphorical and symbolic understanding of religious words can also produce subtle changes in behavior.

Self-reported intolerance of ambiguity, the tendency to perceive ambiguous stimuli as discomforting, increased after exposure to religious words (Sagioglou & Forstmann, 2013). Additionally, priming with religious words led to greater preference for non-ambiguous as opposed to ambiguous artwork and greater certainty in interpreting ambiguous facial expressions, even when controlling for religiosity (Sagioglou & Forstmann, 2013). Religious belief has been previously linked with a high need for order, structure, and predictability (Duriez, 2003). It is suggested that this in turn may explain the intolerance to ambiguity.

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Religious priming is also effective with a number of different variables including risk-taking behavior (Chan, Tong, & Tan 2014), prejudice towards African-Americans (Johnson, Rowatt, & LaBouff, 2010), intergroup bias (Johnson, Rowatt, & LaBouff, 2012; Ramsay, Pang, Shen, & Rowatt, 2014), displays of violence (Bushman, Ridge, Das, Key, & Busath, 2007), and humor creation (Saroglou & Jaspard, 2001).

C. Religiosity and Religious Priming

Religious concepts can theoretically activate a number of different associations and induce both positive and negative behavior. This could be due to the complexity of the construct as well as a disparity in the religious words being used across the studies (Ritter & Preston, 2013). Some authors suggest that, regardless of participants' religiosity, religious priming remains effective because it could potentially activate representation or knowledge of religious norms or pre-existing attitudes (Pichon, Boccato, & Saroglou, 2007). In line with this, Belgians of a Christian background (and regardless of religiosity) engaged in greater sharing of hypothetical gains when primed with Buddhist images than neutral images, lending further evidence to the notion that associations between religion and prosocial behaviors exist independent of religious affiliation (Clobert & Saroglou, 2013). Additionally, it is suggested that religious words may activate thoughts often mentally associated with prosocial perception and behaviors in general (i.e., a prosocial schema). For example, Pichon, Boccato, and Saroglou (2007) found that religious priming enhances accessibility to prosocial related words.

Religious individuals, however, are not only aware of the values and beliefs of religion but have also internalized them. As such, the effect ought to be stronger with this group. Contradictory results emerged, with some studies reporting that religious priming is effective only with religious individuals wherein the primes are personally relevant and meaningful (Rand, Dreber, Haque, Kane, Nowak, & Coakley, 2013; Weisbuch-Remington, Mendes, Seery,

& Blascovich, 2005). Particularly, a recent meta-analysis across 92 religious priming studies has concluded that the effects of religious priming do not extend to individuals who report little to no religiosity (Sharrif, Willard, Andersen, & Norenzayan, 2015). There is nevertheless variation across the studies, whereby some nonbelievers respond effectively to religious priming. When studied in relation to the effects on reasoning in cognition, religious priming is potentially best contrasted with reflective priming (Gervais & Norenzayan, 2012).

CHAPTER II

REFLECTIVE PRIMING

Reflective priming involves prompting participants to think critically with the intent of altering their performance on subsequent tasks. A study by Gervais and Norenzayan (2012) induced reflective thinking via two different modes; visual and semantic. In the first method, participants were presented with an image showing a man engaged in deep thinking (The Thinker by Rodin). This, in turn, led participants to perform better on reflective thinking tasks than participants viewing a neutral image. In the semantic priming condition, participants were exposed to a series of words related to reflective thinking via the scramble sentence task (e.g., think, analyze, rational). This was shown to increase performance on the reasoning task when compared to the control group.

Priming reflective thinking can also be achieved through more implicit means, such as presenting participants with difficult-to-read font which induces cognitive dis-fluency (Alter, Oppenheimer, Epley, & Eyre, 2007). Additionally, adopting a facial expression congruent with effortful thinking (furrowing brows) led participants to be more accurate in their responses than an incongruent facial expression. Reflective thinking was effectively primed when participants were asked to report an instance when thinking carefully about a situation led to a good

outcome (Shenhav, Rand, & Greene, 2012). Instructing participants to think critically about a task also led to less errors on framing biases (making a choice based on how the option is presented) (Simon, Fagley, & Halleran, 2004). Despite there being a number of studies on reflective priming and cognitive style, there is comparatively little work done on religious priming and cognitive style.

CHAPTER III

COGNITIVE STYLE

Cognitive style is the preferred and habitual approach of acquiring and organizing information (Tullett, 1997). It refers to the willingness or tendency to engage in either reflective or intuitive thinking. It is contrasted with cognitive ability which includes the *capacity* for analytic processing as opposed to an inclination for a specific type of processing (Stanovich & West, 2000). An intuitive style or judgment refers to one done with little effort and is viewed as an automatic and often affect-laden process (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Shenhav, Rand, & Greene, 2012). Typical correlates include being contextualized, concrete, domain specific, and more likely to produce biased than normative responses (Stanovich, 1999). Conversely, a reflective judgment involves critically examining the task at hand and is generally a more effortful, deliberative, and analytic process (Pennycook et al., 2012; Shenhav et al., 2012). A reflective style also includes an inhibitory role that suppresses intuitive effects (Evans, 2008). According to the literature, individuals can employ either type at one time or both interactively and have a natural tendency to rely on one or the other systematically (Pacini & Epstein, 1999), depending on prior beliefs and knowledge (Evans, 2008). For example, those with a greater conservative ideology tend to engage less in reflective thinking (Pacini & Epstein, 1999).

A. Cognitive Style and Religious Belief

With regards to cognitive style and religious belief, no studies to date have examined the effects of religious priming on cognitive style. Instead, studies have investigated the correlation between cognitive style and religious belief and the effects of manipulating cognitive style on levels of religious belief. For example, Shenhav, Rand, and Greene (2012) assessed for reflective cognitive style through the Cognitive Reflection Task (CRT), which includes a set of basic numeric problems whose incorrect answers are intuitively compelling. They found that individuals who gave the intuitive and incorrect answer, and thus yielding a low CRT score, expressed greater religious belief than those who gave the correct and less intuitive answer (Shenhav, Rand, & Greene, 2012). The link between low CRT scores and a belief in God was present even when controlling for cognitive ability (IQ) and personality traits. Participants were then induced to think intuitively by prompting them to recount a story in which their first instincts or intuitions led to the right answer or to a good outcome. Inducing participants to think of a story where intuition was validated led them to express stronger religious belief than those who had been asked to recount a story in which intuition was discredited or produced a negative outcome.

Pennycook, Cheyne, Seli, Koehler, and Fugelsang (2012) similarly found a negative relationship between religious belief and reflective cognitive style even when controlling for cognitive ability. A new dimension labeled qualitative religious belief, measuring more detailed variations or degrees of religious beliefs such as deism or agnosticism, was added. It was found that those with a reflective cognitive style might not only reject God but also may hold more abstract and less conventional notions of God (e.g., deism; in which God is viewed as the creator but does not interfere with daily affairs).

Using a different methodological approach, Gervais and Norenzayan (2012) asked

participants to rate religious belief after being presented with different images that served as

primes: either one illustrating a man engaged in reflective thinking (The Thinker) or a control

painting, depicting a man engaged in a neutral activity. Results indicated that those who viewed

the image of the thinker, which presumably helped trigger reflective thinking, expressed lower

religious belief than those viewing the neutral picture. Participants were then exposed to a

string of words related to thought, such as 'ponder', 'reflect,' and 'analyze'. The participants in

the control condition received a set of arbitrary and unrelated words, such as 'hammer',

'brown,' and 'bird'. Those exposed to the reflective prime reported lower religious belief. The

results were then validated with a larger and more diverse population via online recruitment

with variations in age, education level, and income. Additionally, participants who were

presented with the religious beliefs questionnaire in a difficult-to-read font had greater

activation of reflective thinking and therefore expressed lower religious belief than their

counterparts (Gervais & Norenzayan, 2012). Cognitive dis-fluency, which involves using

unpleasant font and other experiences of difficulty, is known to enhance reflective thinking and

reasoning (Alter, Oppenheimer, Epley, & Eyre, 2007).

Moreover, individuals with low religious belief were able to perform better on logical

reasoning tasks (i.e., syllogisms) (Pennycook, Cheyne, Koehler, & Fugelsang, 2013).

Specifically, the tasks included valid arguments but with unbelievable conclusions (such as,

whales can walk). Those who had high religious belief were more likely to go with the intuitive

answer, labeling valid syllogisms with unbelievable conclusions as invalid. They made more

errors on these tasks even when general cognitive ability, time spent on problems, and other

demographic variables were taken into account. Nonbelievers also spent a greater amount of

time overall on the presented tasks than believers, a finding that is more in line with the

reflective style (which is slower and more effortful compared to the intuitive style). Overcoming initial intuitive responses is expected to take a longer time, implying that nonbelievers are more willing to engage with the reflective process prompted by the material presented (Pennycook et al., 2013). That is, the tendency to engage longer with the material is one mechanism that is predictive of lower religious belief, regardless of the correctness of the answer. A recent study employing social media found that the language used in tweets indicated a higher frequency of words related to reflective thinking style for nonbelievers (Ritter, Preston, & Hernandez, 2014).

B. Explaining Cognitive Style and Religious Belief

From an evolutionary viewpoint, the emergence of religious belief is regarded as the byproduct of a number of separate social cognitive tendencies and intuitive processes (e.g., anthropomorphism, theory of mind, agent detection, and apophenia) (Kirkpatrick, 2004). Reflective processes, by contrast, work to inhibit or override these intuitive tendencies. In essence, when confronted with religious ideologies, nonbelievers' reflective thinking processes are activated to counteract the intuitive, religious thoughts (Pennycook, 2014). Inducing a reflective style was shown to reduce religious belief, indicating further that religious beliefs can be contextually altered and undergo a form of reexamination when reintroduced (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012). Alternatively, individuals who are drawn to intuitive explanations may believe in religion because it strengthens their already-formed intuitive beliefs and supports a host of other intuitions (Shenhav, Rand, & Greene, 2012). Although the relation between reflective thinking and religious belief is well-studied, it is noteworthy that the direct manipulation of religiosity in relation to both cognitive style and cognitive biases has not been attempted yet.

CHAPTER IV

COGNITIVE BIASES

Cognitive biases are simple processing mechanisms of low expense that could potentially lead to inaccurate or irrational judgments. They include systematic errors such as belief bias (judging the validity of an argument based on the plausibility of the conclusion), framing bias (explained above), and outcome bias (making a decision based on its final outcome) (Toplak, West, & Stanovich, 2011). This general deviation in judgment, however, is both consistent and predictable (Toplak et al., 2011.). Oreg and Bayazit (2009) have theoretically proposed three distinct categories of biases: verification bias, regulation bias, and simplification bias. In their interpretation, biases emerge as a consequence of attempting to achieve three basic motivations. Verification biases are related to core self-perception and evaluations and include enhancement or self-serving biases. Regulation biases occur when trying to approach pleasure and avoid pain, whereas simplification biases occur when attempting consistency in the way in which we comprehend reality. The term 'simplification bias' is used to describe biases which, in their attempt to simplify reality, cause distortions and inaccuracies (that is, an inappropriate use of heuristics). This class of biases is most closely related to cognitive style (Oreg & Bayazit, 2009). Specific examples include illusory correlation (perceiving a relationship between two variables when none exists) as well as the conjunction fallacy and base-rate fallacy, both of which are explained below.

A. Conjunction Fallacy

Conjunction fallacy, originally studied by Tversky and Kahneman (1983), occurs when assuming that a specific condition is more likely than a general one. Two events occurring together, however, are mathematically less probable than either of these events occurring alone. Individuals faced with the Linda Problem, which requires them to choose if Linda is a bank

teller or a bank teller *and* a feminist, may opt for the second option based on other representational information offered (e.g., 'Linda majored in philosophy'). This sort of information may make the second option appear as more representative or probable. According to the laws of probability, however, the probability of a conjunction, P (A&B) cannot exceed the probability of its single parts, P (A) or P (B). A bias occurs when individuals provide an intuitive judgment of probability.

One subset of the conjunction fallacy is the causal conjunction fallacy. In this case, two phrases that appear as a cause and effect are mistakenly judged as more likely than a single phrase (i.e., the effect alone). For example, when asked to assess which is more likely that "Mr F. has had one or more heart attacks" or that "Mr F. has had one or more heart attacks and is over 55 years old," it may be more compelling to choose the latter simply because the cause and effect are presented adjacently, making the condition appear more convincing (Tversky & Kahneman, 1983). In this problem, the same logic also applies wherein requiring two conditions to be met (Mr. F having heart attacks *and* being over 55 years old), is less likely than demanding one condition (that Mr. F has had heart attacks).

Previous studies have shown a clear relationship between high reflective thinking, as measured by the Cognitive Reflection Task, and less instances of committing this bias (Oechssler, Roider, & Schmitz, 2009; Toplak, West, & Stanovich, 2011). As a result of this research, the following study proposes to examine the effects of reflective and religious priming using this particular fallacy. The conjunction fallacy is commonly measured with one question and requires only a minute or two for completion. This practicality in administration will also help prevent priming decay. Since religious belief has been linked to intuitive thinking (Shenhav, Rand, & Greene, 2012), priming with religious thought is expected to alter

performance on reflective thinking tasks requiring normative judgments, such as the

conjunction fallacy.

B. Base Rate Fallacy

As with the conjunction fallacy, high reflective thinking has similarly been linked to a

lower level of base rate fallacy (Toplak, West, & Stanovich, 2011) and will be further

examined with religious and reflective priming in the present study. In tasks measuring the base

rate fallacy, participants are presented with two pieces of information: the composition of a

sample (e.g., 995 nurses, 5 doctors) and stereotypical information pertaining to the smaller

group (e.g., Jake lives in an expensive area). When asked to decide if Jake is a nurse or a

doctor, participants who respond with doctor are evaluating the problem based on stereotypical

information representing a single category rather than the probabilities of the categories

(Kahneman & Tversky, 1973). A bias occurs when participants decide based on descriptive

rather than base rate information. This bias is similarly simple to measure and relates clearly to

reflective thinking (Toplak, West, & Stanovich), while it negatively correlates with religiosity

(Pennycook, Cheyne, Koehler, & Fugelsang, 2013).

CHAPTER V

COGNITIVE BIASES AND COGNITIVE STYLE

While research on religiosity and cognitive biases is scarce, there is a clear relationship

between cognitive style and cognitive biases. High reflective thinking is correlated with lower

instances of the conjunction fallacy (explained above) and the conservatism fallacy

(maintaining old information and under weighing new evidence) (Albaity, Rahman, &

Shahidul, 2014; Hoppe & Kusterer, 2011; Oechssler, Roider, & Schmitz, 2009). A study by

West, Toplak, and Stanovich (2008) reported a positive correlation between avoiding biases

(using a composite score of the heuristics-and-biases task, including a total of 15 biases) and high reflective thinking, critical thinking, and reasoning skills. Additionally, Toplak, West, and Stanovich (2011) found that a high cognitive reflection task (CRT) score is a powerful predictor of performance on the heuristic-and-biases task. In essence, individuals who have a strong reflective cognitive style are less likely to commit these biases. With heuristic tasks, the initial response of applying the heuristic needs to be inhibited and replaced with a more appropriate response. This inhibition process requires reflectivity (West, Toplak & Stanovich, 2008).

Other cognitive biases correlated with low CRT scores include the base rate fallacy (Pennycook, Cheyne, Koehler, & Fugelsang, 2013), belief bias, which was explained above, (Trippas, Pennycook, Verde, & Handley, 2015), and overconfidence bias (when confidence in one's judgment is greater than its objective accuracy) (Hoppe & Kusterer, 2011). Moreover, fallacies in base rate and syllogistic tasks were accompanied by intuitive 'feelings of rightness' reported from participants (Thompson, Prowse, & Pennycook, 2011). Feeling of rightness was predictive of the subsequent cognitive style used, with a strong feeling indicative of the use of an intuitive style. In other words, this metacognitive process guides the decision of whether or not reflective thinking is activated.

A high need for reflective thinking was also associated with lower rates of the framing fallacy (Carnevale, Inbar, & Lerner, 2011; Chatterjee, Heath, Milberg, & France, 2000; McElroy & Seta, 2003) and the sunk cost fallacies (assuming that further investment is warranted because previous resources have been invested), even in a sample of high-level leaders (Carnevale et al., 2011). Encouraging individuals with high reflective thinking abilities to engage in greater depth of processing effectively reduced framing effects (Simon, Fagley, & Halleran, 2004). Similarly, individuals who were induced to think reflectively were not

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influenced by the framing of a problem. In one recent study, less religious participants performed better on base-rate probability tasks than their religious counterparts, even with the content of the task being non-religious (Pennycook, Cheyne, Koehler, & Fugelsang, 2013). Additionally, nonreligious participants had greater response times to the incongruent base rate problems presented, indicating a conflict or contradiction detection on the part of the participant.

CHAPTER VI

EXPLAINING COGNITIVE BIASES, COGNITIVE STYLE

AND RELIGIOUS BELIEF

Stanovich and West (2000) explain that individuals with a reflective thinking style are able to reduce difficult problems to representations that are devoid of context, making them less likely to take non-relevant information into account (e.g., how the problem is framed). From a theoretical perspective, one explanation suggests that reflective thinkers are less religious because they more easily detect conflicts or contradictions between immaterial (e.g., religious) and material beliefs about the world. This trait, termed cognitive conflict sensitivity, is perceived as the underlying mechanism at work (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014).

Believing in the supernatural implicitly means agreeing to the violation of certain cognitive principles which normally govern our perception and interaction with the world (Atran & Norenzayan, 2004). A belief in angles, for example, violates the folk mechanical understanding that beings cannot pass through solid objects. Religious individuals may be less sensitive to detecting contradictions in cognitive outputs (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014), possibly making them more likely to commit cognitive biases, regardless of

the content they are presented in. While an established relation between reflective thinking and cognitive biases exists, a review of the literature on PsycInfo and GoogleScholar indicated that no studies to date have examined the causal link between religious priming and the use of cognitive biases and cognitive style.

CHAPTER VII

AIMS AND HYPOTHESES

A number of studies have examined the effects of religious priming on specific behaviors, including prosocial behavior, attention shifts, and agency. Similarly, reflective priming was effective in changing performance on decision-making tasks. The present study attempts to shed light on the cognitive consequences of religious priming when compared to reflective and neutral primes. In particular, cognition was assessed through cognitive style and cognitive biases. Cognitive style includes two modes of processing information, reflective and intuitive. The Cognitive Reflection Task (CRT) measures the degree of reflective thinking with questions that appear simple yet require greater effort. A high performance on this measure has been linked to both lower religious belief and a lesser susceptibility to cognitive biases. The conjunction and base rate fallacy are examples of such biases. Some studies have noted the effect of religious priming regardless of religious belief (Ahmed & Salas, 2011), while others have reported otherwise (Sharrif, Willard, Andersen, & Norenzayan, 2015; Weisbuch-Remington, Mendes, Seery, & Blascovich, 2005).

As a result of these findings, the effect of religious and reflective priming on the conjunction fallacy, base rate fallacy, and CRT was examined while controlling for religiosity. In this study, participants were exposed to either a religious, reflective, or neutral prime via the scrambled-sentence task. They then completed the CRT, one problem measuring the conjunction fallacy, one problem measuring the base rate fallacy, and a scale of religiosity. In sum, studies have shown a negative correlation between religious belief and CRT. Cognitive biases are considered reasoning errors that individuals with high CRT scores are less likely to commit. Therefore, we hypothesized the following:

Hypothesis 1: Participants in the religious priming condition will score lower on the CRT than participants in the reflective and neutral priming condition.

Hypothesis 2: Participants in the religious priming condition will commit the conjunction and the base rate fallacy more often than those in the reflective and neutral priming condition.

Hypothesis 3: Participants in the reflective priming condition will score higher on the CRT than participants in the neutral priming condition.

Hypothesis 4: Participants in the reflective priming condition will be less likely to commit the conjunction and base rate fallacy than participants in the neutral priming condition. Religiosity will be controlled for in the above analyses.

Hypothesis 5: In the religious priming condition, participants with high religiosity will score lower on CRT and cognitive biases than participants with low religiosity in the same condition.

Hypothesis 6: In the reflective priming condition, participants with high religiosity will score lower on CRT and cognitive biases than participants with low religiosity in the same condition.

Hypothesis 7: In the neutral priming condition, participants with high religiosity will score lower on CRT and cognitive biases than participants with low religiosity in the same condition.

CHAPTER VIII

METHOLODGY

A. Participants

The participants in this study included undergraduate students from the American University of Beirut (AUB) in Lebanon. The method of recruitment was through the introductory psychology research pool. A convenient sample of students who chose to participate was recruited and was given an extra point on their final grade. The demographic included Lebanese males and females between the ages of 18 and 22. Similar studies have used a sample of 70 per group (Gervais & Norenzayan, 2012). Additionally, a power analysis on G* power reveals a required sample size of 180. Therefore, a total sample size of 180 was recruited (60 per group). A total of 3 participants were removed after checking for outliers and responses on the manipulation check. The final sample of 177 included 117 females and 60 males.

B. Research Design

The study followed an experimental between-subjects design. An ANCOVA was conducted to assess the differences between the three groups (religious, reflective, and neutral condition) on the continuous dependent variable of cognitive style. Since the conjunction fallacy and base rate fallacy are both categorical dependent variables, a binary logistic regression was conducted to assess for group differences. Religiosity was controlled for in all tests. For hypotheses 5, 6, and 7, a correlational test was conducted to assess the relationship between religiosity and cognitive style. Additionally, three binary logistic regressions were carried out to look at groups differences within conditions on categorical cognitive biases.

C. Instruments

The following measures/tasks were used:

   1. Demographic Variables (Appendix A). Gender, age, major, and year at university were measured using one item each.

   2. Scramble-Sentence Paradigm. Participants were randomly assigned to one of three priming conditions: religious, reflective, and neutral priming. The priming was done via the scramble sentence task originally introduced by Srull and Wyer (1979). The task entails unscrambling 10 five-word sentences with the aim of creating a grammatically correct four-word sentence by removing an extra word. For example, "felt she eradicate spirit the" should become "she felt the spirit." In the religious priming condition, participants unscrambled 10 sentences in total, 5 related to religion and 5 neutral sentences. Unscrambled sentences related to religion, adapted from Sharrif and Norenzayan (2007), are as follows: "He worships his idol", "Have faith in her", "Pray for the poor", "The book was sacred", and "It was a miracle." Similarly, the reflective priming condition contained 5 sentences related to reflective thinking and 5 neutral sentences. The reflective thinking sentences, as introduced by Gervais and

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Norenzayan (2012), included: "Analyze the numbers carefully", "His reason is obvious", "They ponder their options", "I think all day", "Computers are rational machines." The neutral sentences included words unrelated to religion or reflective thinking and forming no other single concept (Shariff & Norenzayan, 2007). Participants in the final group unscrambled 10 neutral sentences such as, "He finished it yesterday" and "She was always worried" (Appendix A).

3. Cognitive Reflection Task (CRT) (Appendix A). The CRT is a three-item performance measure used to assess cognitive style (Campitelli & Labollita, 2010). The three items are numerical problems which require participants to overrule their initial intuitions to arrive at the correct answer (Frederick, 2005). If the participant becomes aware that the intuitive response is not correct, finding the correct solution requires relatively simple mathematical calculations (Campitelli & Gerrans, 2014). An example of the items includes: A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost? (intuitive answer: 10 cents; correct answer: 5 cents). The CRT has a reported cronbach alpha of .66 (Campitelli & Gerrans, 2014).

4. Cognitive Biases: The following cognitive biases were measured: Conjunction fallacy and base rate fallacy. Conjunction fallacy was assessed via the following problem: "A health survey was conducted in a representative sample of adult males in British Columbia of all ages and occupations. Mr F. was included in the sample. He was selected by chance from the list of participants. Which of the following statements is more probable? (a) Mr F. has had one or more heart attacks or (b) Mr F. has had one or more heart attacks and he is over 55 years old." (Tversky & Kahneman, 1983).

The base rate fallacy was presented as such: "In a study, 1,000 people were tested. Among the participants there were 995 nurses and five doctors. Jake is a randomly chosen participant of

this study. Jake is 34 years old. He lives in a beautiful home in an expensive area. He is well spoken and very interested in politics. He invests a lot of time in his career. What is more likely? (a) Jake is a nurse or (b) Jake is a doctor" (De Neys & Glumicic, 2008).

5. Religiosity To measure religiosity, an 8-item religiosity scale (Rebeiz & Harb, 2009) was used (Appendix A). This is an 8-item scale that measures intrinsic religiosity and has been previously used in Lebanon. The items are rated on a seven-point Likert type scale ("Strongly Agree" to "Strongly Disagree"). The scale has a high reliability of .92 (Rebeiz & Harb, 2009).

D. Procedure

An announcement for the study was circulated to the Introduction to Psychology research pool (Appendix B). After providing their consent, participants were given a link to the survey, containing the task and questionnaire, presented through the survey program LimeSurvey. Participants were randomly assigned to one of three groups: religious priming condition, reflective priming condition or neutral priming condition. All groups completed the scrambled sentence task (with a total of 10 sentences), the Cognitive Reflection Task (CRT), a question assessing for each the conjunction as well as the base rate fallacy, and lastly, the religiosity questionnaire. The CRT and the cognitive biases were counterbalanced to control for order effects. The first page included the informed consent (Appendix C) and instructions. In order to prevent participants from knowing about the content of the priming, the task was presented as a measure of verbal fluency and the study was framed as investigating verbal fluency and cognition. Participants were asked to form a meaningful phrase from four out of the five available words. The instructions included an example sentence that contains the scrambled words and the solution. The instructions were as follows "Please complete the following verbal fluency task. Do your best to complete every item. Unscramble the following groups of words to make a four word phrase or sentence by dropping the irrelevant word. For

example, "high winds the flies plane" becomes "The plane flies high" (Shariff & Norenzayan, 2007).

In the religious priming condition, participants completed a scramble sentence task with 5 sentences containing words related to religion and 5 sentences containing neutral words. Similarly, participants in the reflective priming condition completed a scramble sentence task with 5 sentences containing words related to reflective thinking and 5 sentences containing neutral words. The sentences were presented in a random order. Participants in the neutral condition completed 10 sentences, all of which contain neutral words. The five neutral sentences were the same in the religious and reflective condition. In the neutral condition, five more sentences were added to the same 5 neutral ones. This task was estimated to take 7 minutes to complete. Three versions of the same survey were created and participants were sent one of the three versions.

Afterwards, participants completed the CRT and the cognitive-biases tasks, which were estimated to take 7-10 minutes in total. The priming effect was expected to last this duration since previous studies had shown that long-term semantic priming is effective after an 8-item lag between prime and target word (Becker, Moscovitch, Behrmann, & Joordens, 1997). Additionally, in tasks of semantic relatedness, exposure to certain sentences altered performance on a word association task even after a 20-minute delay (Rodd, Cutrin, Kirsch, Millar, & Davis, 2012).

The religiosity scale was estimated at 3-5 minutes. A manipulation check was also conducted whereby participants were asked about their suspicions, as modeled from Bargh and Chartrand (2000) (Appendix D). Finally, the participants were thanked and debriefed. The debriefing procedure included a page that appeared after participants clicked "submit", that

explained the real purpose of the study and why it was necessary to withhold some information (Appendix E).

CHAPTER IX

RESULTS

A. Results of Pilot

A pilot study with 15 participants (5 per group) was carried out after IRB approval was granted. There were variations in the responses for both the CRT and the base rate fallacy. Notably however, none of the participants answered the Linda problem (representing the conjunction fallacy) correctly. Tversky and Kahneman (1983) have previously reported that only about 15% of their original sample answered the Linda problem correctly. As a result, a different problem measuring the conjunction fallacy was used. The health-survey problem was shown to have a higher frequency of correct answers in previous studies (42% answered correctly).

A health survey was conducted in a representative sample of adult males in British Columbia of all ages and occupations. Mr F. was included in the sample. He was selected by chance from the list of participants. Which of the following statements is more probable? (Check one)

Mr F. has had one or more heart attacks.

Mr F. has had one or more heart attacks and he is over 55 years old.

B. Preliminary Analyses

Preliminary analyses involving missing value analysis, exploration of univariate and multivariate outliers and normality testing were conducted prior to the main analyses.

1. Missing Value Analysis. A missing value analysis showed that all the variables had a percentage of missing values below 5%. Thus, these missing values do not pose problems for subsequent analyses and were not removed. This also indicates that the Little MCAR test and an independent sample t-test were not needed.

2. Manipulation Check. Out of a total of 180 participants, 1 case was removed as a result of the participant replying 'how priming on religion affects my answers' in response to the question on the purpose of the study. None of the remaining participants correctly guessed the purpose of the study.

3. Univariate and Multivariate Outliers. Univariate outliers were inspected by converting all variables into Z-scores through the descriptive command. Univariate outliers were defined as values not between + or − 3.29, as this represents the standard deviation marker where scores are said to be too far from the mean to be acceptable. Two univariate outliers were found with Z-scores above ±3.29 standard deviations for the variable age and these were case number 31 from version 1 of the survey and case number 119 from version 2 of the survey.

The presence of multivariate outliers was assessed through Mahalanobis distance through SPSS Regression. With the CRT composite score as the dependent variable, and age, gender, year, priming group, religiosity, major, conjunction, and base rate fallacy as independent variables, the degree of freedom was 8. Any case greater than χ^2 (8) = 26.12, p <.001 was considered a multivariate outlier. Cases number 31 and 119 emerged as outliers. Since these cases were also univariate outliers, they were removed from the dataset.

4. Normality. Normality of the variables was investigated by examining Z-scores of skewness. The z-skewness was calculated by dividing Skewness with the Standard Error of Skewness. This method was chosen because with a large sample size, Kolmogorov-Smirnov

test would be very sensitive to any deviations from normality. A Z skew value of ±3.29 was used as the marker for significant skew and violation of normality. The variables age, religiosity and CRT had Z skew value of above the +3.29, violating the assumption of normality: Religiosity (4.02), CRT (3.78) and age (7.79). However, the F test is robust to violations of normality when the group sizes are equal (Field, 2009). Additionally, since in the current sample the groups are of almost equal size, the non-normality of the dependent variable was not considered a problem and the analysis was continued.

C. Descriptive Statistics

The total sample size for this study was 177, with 117 of the participants were female and 60 male. The average age of the participants was M=18.51, SD=0.80. Of the total sample, 123 were sophomores followed by 27 juniors, 21 freshmen, and 6 seniors. A total of 20 different majors were listed. These were then broadly categorized into 'scientific' and 'humanities/social sciences.' Examples of majors under the scientific category included, biology, chemistry, math, engineering, medical imaging, nursing, computer science, environmental health, nutrition and food sciences. The humanities and social science category included political studies, education, English literature, economics, psychology, sociology and media studies. Of the sample, 120 participants had majors under the scientific label, whereas 57 were studying humanities or social sciences.

The religiosity level of the sample was slightly below the midpoint of 3.5 (M=3.07, SD=1.53), indicating a sample leaning towards religiosity. The average questions answered correctly on the CRT, out of a total of 3, was 1 (SD=1.09). More specifically, 43.5% of the sample did not solve a single problem correctly on the CRT, obtaining a score of 0. Whereas, 27% solved one correctly, 14% solved 2 correctly and 15% solved all 3 correctly. For the

conjunction fallacy, 108 (61%) of the total sample answered it correctly while for the base rate

fallacy, 96 (54%) of the sample had answered it correctly.

Sixty individuals completed version 1 of the questionnaire undergoing reflective

priming (37 females and 23 males). The level of religiosity for this group was below midpoint

(M=3.13 SD=1.52), leaning slightly towards religiosity. The average score on the CRT for this

group was (M=1.10, SD=1.12). For the conjunction fallacy, 43 answered correctly and 17

incorrectly. Thirty-two individuals got the base rate correct while 28 got it incorrectly.

Fifty-six participants completed the religious priming (36 females and 20 males).With

religiosity being near the midpoint (M=2.97, SD=1.45), the sample was leaning more so

towards religiosity. The average score on the CRT for this group was (M=1.09, SD=1.20). For

the conjunction fallacy, there were 30 correct and 26 incorrect answers. For the base rate, 33

answered correctly and 23 incorrectly.

Sixty-one participants completed the neutral priming condition (44 females and 17

males). The average religiosity for the sample was (M=3.12, SD=1.64), leaning towards

religiosity. The average score on the CRT for this group was (M=.85, SD=.96). For the

conjunction fallacy, 35 correct and 26 incorrect answers were given. Thirty-one correct and 30

incorrect answers were given for the base rate.

D. Main Analyses

1. Statistical Assumptions for Factorial ANCOVA. One of the assumptions for an

ANCOVA analysis is that the data on the dependent variable and the covariate be measured at

an interval level. In this study this assumption was met. The covariate religiosity was measured

on a Likert scale from 1 to 7 and the dependent variable of CRT was marked 1 to 3.

A second assumption of ANCOVA is the assumption of independence. Scores collected

on the dependent variable should be independent of each other. According to Tabachnick and

Fidell (2014), there is no test to check for this assumption and researchers should assume that it is met. Since there is no statistical analysis to test this assumption and the surveys were randomly assigned to participants at different times, we are assuming that all the data points collected are independent of one another.

A third assumption is that the data of the dependent variable (CRT) and covariate (religiosity) across different levels of the IV (priming groups) should be normally distributed. Normality was tested through examining z-scores of skewness by dividing z-score skewness by standard error of skewness. Any z-score skewness $< |3.96|$ at significance level above 0.05 would be considered non-significantly normal.

The Z-skewness of CRT across reflective priming group was Z= 2.1 $< |3.29|$, p < .05; CRT across religious priming group is Z-skewness= 1.72 $< |3.29|$, p < .05; CRT across neutral priming group = 2.88 $< |3.29|$, p < .05. This indicated that the assumption of normality was met for the CRT across levels of the independent variable priming groups.
For the covariate religiosity across priming groups, Z-skewness= 2.52 $< |3.29|$, p < .05 for the reflective priming group. For the religious priming group, Z-skewness= 2.49 $< |3.29|$, p < .05. For the neutral priming group, Z-skewness= 2.16 $< |3.29|$, p < .05. Therefore, the assumption of normality was met.

Another assumption of ANCOVA is homogeneity of variance. The homogeneity of variance of CRT for the three groups was assessed using Levene's tests. The omnibus Levene's test through the ANCOVA analysis revealed that for the dependent variable CRT the variances were equal for all groups, $F (2, 174) = 2.88$, p>0.05. Thus, homogeneity of variance was met. Additionally, the test indicated that for the covariate religiosity the variances were equal for all groups, $F (2, 174) = 1.29$, p>0.05. Thus, homogeneity of variance was also met.

Assumption of homogeneity of regression slopes is a specific assumption of ANCOVA. The relationship between the dependent variable and the covariate should be the same at each level of the independent variable. This assumption was tested by running an ANCOVA using a customized model and assessing the interaction of the dependent variable and the covariate. The assumption is met when the interaction is not significant.

The result of this test showed that the assumption was met with $F(3,161)= .13$, p>.05 ns, for the interaction of year and religiosity. The assumption was also met with $F(1,161)= .08$ p>.05 for the interaction of gender and religiosity. Finally, for the interaction of group and religiosity F(2, 161)=.92 p>.05, and the interaction of religiosity and major F(1 ,161)= .01, p >.05, the assumption was also met.

2. Main Effects and Interaction Effects. A within-subject factorial ANCOVA was run to analyze the main effects and interaction effects of priming group, age, gender, major, year, and the covariate religiosity on the dependent variable CRT. The analysis revealed that there is no significant effect of the covariate religiosity on the dependent variable CRT, F (1,117) = .35, p>.05. After controlling for the covariate religiosity, the main effect of IV priming group was not significant with CRT, F(2, 117)=2.09, p>.05, ns.

There was a significant effect of gender on CRT, F (1, 117) = 7.73, p < .05, with males performing significantly better than females. After controlling for the covariate religiosity, the analysis revealed no significant interaction effect of group and gender on CRT, F(2, 117)=1.02, p>.05, ns. Similarly, the analysis revealed no significant interaction effect of group and year on CRT, F(4, 117)= 2.11, p>.05, ns.

After controlling for the covariate religiosity, the analysis revealed no significant interaction effect of group and major on CRT, F(2, 117)= 2.01, p>.05, ns, and no significant interaction effect of group and age on CRT, F(4, 117)= 2.03, p>.05, ns.

Table 1
Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	100.29[a]	59	1.70	1.81	.00
Intercept	15.08	1	15.08	16.08	.00
Religiousmean	.33	1	.33	.35	.56
Group	3.92	2	1.96	2.09	.13
Gender	7.24	1	7.24	7.73	.01
Year	2.16	3	.72	.77	.52
Majordivided	.05	1	.05	.05	.82
Age	8.49	4	2.12	2.26	.07
Group * Gender	1.91	2	.96	1.02	.36
Group * Year	7.91	4	1.98	2.11	.08
Group * majordivided	3.76	2	1.88	2.00	.14
Group * Age	7.63	4	1.1	2.03	.09
Gender * Year	3.10	2	1.55	1.66	.19
Gender * majordivided	.78	1	.78	.83	.36
Gender * Age	.07	1	.07	.07	.79
Year * majordivided	.24	1	.24	.26	.61
Year * Age	6.17	3	2.06	2.19	.09
majordivided * Age	1.98	2	.99	1.06	.35
Group * Gender * Year	.10	1	.10	.11	.74
Group * Gender * majordivided	2.07	1	2.07	2.21	.14
Group * Gender * Age	4.29	2	2.15	2.29	.11
Group * Year * majordivided	.00	0	.	.	.
Group * Year * Age	.02	1	.02	.02	.90
Group * majordivided * Age	2.37	2	1.19	1.27	.29

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Gender * Year * majordivided	.00	0	.	.	.
Gender * Year * Age	.00	0	.	.	.
Gender * majordivided * Age	.03	1	.03	.03	.87
Year * majordivided * Age	.00	0	.	.	.
Group * Gender * Year * majordivided	.00	0	.	.	.
Group * Gender * Year * Age	.00	0	.	.	.
Group * Gender * majordivided * Age	.00	0	.	.	.
Group * Year * majordivided * Age	.00	0	.	.	.
Gender * Year * majordivided * Age	.00	0	.	.	.
Group * Gender * Year * majordivided * Age	.00	0	.	.	.
Error	109.69	117	.94		
Total	391.00	177			
Corrected Total	209.98	176			

a. R Squared = .478 (Adjusted R Squared = .214)

3. Binary logistic regression for conjunction and base rate fallacy. Two binary logistic regressions were conducted to assess if there are any differences between the three priming groups on the conjunction fallacy and base rate fallacy while controlling for age, gender, religiosity, major, and year. For the conjunction fallacy, overall, the model was not a

significant fit of the data. A test of the full model against a constant only model was not

statistically significant χ^2 (7)= 11.79, *p*> .05.

However, in terms of the specific predictor 'groups', there is a significant difference

between the religious and reflective group on performance on conjunction fallacy, with the

religious group performing significantly lower than the reflective priming group (Wald=4.53,

df=1, p<.05). The B is negative, indicating that group 1 (the religious priming group)

performed significantly less than group 2 (reflective priming).

Table 2
Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	11.79	7	.11
	Block	11.79	7	.11
	Model	11.79	7	.11

Table 3
Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	Group			4.87	2	.08	
	Group(1)	-.85	.40	4.53	1	.03	.43
	Group(2)	-.65	.40	2.61	1	.11	.52
	Age	.10	.25	.16	1	.69	1.11
	Gender	-.11	.35	.11	1	.74	.89
	Year	.59	.34	2.97	1	.08	1.80
	majordivided	-.17	.39	.20	1	.66	.84
	religiousmean	.04	.11	.12	1	.72	1.04
	Constant	-1.85	4.199	.19	1	.66	.16

a. Variable(s) entered on step 1: Group, Age, Gender, Year, major divided, religious
mean.

For the base rate fallacy, overall, the model was not a significant fit of the data. A test of

the full model against a constant only model was not statistically significant χ^2 (7)= 5, *p*> .05.

Similarly, the Wald statistic demonstrated that there was no significant predictor (*p*> .05).

Table 4
Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	5	7	.66
	Block	5	7	.66
	Model	5	7	.66

Table 5
Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	Group			.53	2	.77	
	Group(1)	.21	.38	.30	1	.58	1.23
	Group(2)	-.06	.38	.02	1	.88	.94
	Age	.31	.24	1.62	1	.20	1.36
	Gender	.04	.33	.02	1	.90	1.04
	Year	-.11	.32	.11	1	.75	.90
	majordivided	-.58	.38	2.30	1	.13	.56
	religiousmean	.04	.10	.13	1	.72	1.04
	Constant	-4.79	4.07	1.39	1	.24	.01

a. Variable(s) entered on step 1: Group, Age, Gender, Year, majordivided, religious mean.

A correlation matrix was conducted to assess the relationship between CRT scores and religiosity. Results indicated that there is no significant relationship. However, it is near significance Pearson's $r= .11$, $p > .05$. (p= .08), indicating that higher scores are associated with higher religious disbelief.

Table 6
Correlations

		CRTcomposite	Religiousmean
CRTcomposite	Pearson Correlation	1	.10
	Sig. (1-tailed)		.08
	N	177	177
Religiousmean	Pearson Correlation		1
	Sig. (1-tailed)		
	N		177

A correlation matrix was produced to assess the relationship between religiosity and scores on the cognitive reflection task in each of the three groups.

Table 7
Correlations

reflective/religious/neutral			CRTcomposite	Religiousmean
Reflective	CRTcomposite	Pearson Correlation	1	.11
		Sig. (1-tailed)		.21
		N	60	60
	Religiousmean	Pearson Correlation		1
		Sig. (1-tailed)		
		N		60
religious	CRTcomposite	Pearson Correlation	1	.21
		Sig. (1-tailed)		.06
		N	56	56
	Religiousmean	Pearson Correlation		1
		Sig. (1-tailed)		
		N		56
Neutral	CRTcomposite	Pearson Correlation	1	.01
		Sig. (1-tailed)		.49
		N	61	61
	Religiousmean	Pearson Correlation		1
		Sig. (1-tailed)		
		N		61

There was no significant correlation between religiosity and CRT scores in the reflective priming group: Pearson's $r= .12$, $p > .05$. Similarly, in the religious priming group, there was no significant correlation between religiosity and cognitive style, however it is close to significance level: Pearson's $r=.21$, $p> .05$ (P=.06). The near-significant positive relationship implied that a greater score on the religiosity scale (from 1 to 7 with 7, indicating low religiosity) is associated with higher performance (better score) on the CRT. In the neutral priming condition, there is no correlation between religiosity and cognitive style with a Pearson's $r= .005$, $p > .05$.

Additionally, three binary logistic regressions were conducted to look at group differences within the three priming conditions separately between religiosity and each of the conjunction and base rate fallacies. That is, if religiosity within each group is a significant predictor of performance on the conjunction and base rate fallacy.

For the conjunction fallacy, overall, the model was not a significant fit of the data. A test of the full model against a constant only model was not statistically significant χ^2 (1)= .39, $p>$ .05, for the reflective priming group, for the religious priming group, χ^2 (1)= .63, $p>$ .05 or for the neutral priming group, χ^2 (1)= .18, $p>$ .05. This indicated that within each group religiosity was not a significant predictor of performance on the conjunction fallacy.

Table 8
Omnibus Tests of Model Coefficients

reflective/religious/neutral			Chi-square	Df	Sig.
Reflective	Step 1	Step	.39	1	.53
		Block	.39	1	.53
		Model	.39	1	.53
religious	Step 1	Step	.63	1	.43
		Block	.63	1	.43
		Model	.63	1	.43
Neutral	Step 1	Step	.18	1	.67
		Block	.18	1	.67
		Model	.18	1	.67

Table 9
Variables in the Equation

reflective/religious/neutral			B	S.E.	Wald	df	Sig.	Exp(B)
Reflective	Step 1[a]	religiousmean	.12	.19	.38	1	.54	1.13
		Constant	.55	.66	.71	1	.40	1.74
religious	Step 1[a]	religiousmean	-.15	.19	.62	1	.43	.86
		Constant	.59	.62	.88	1	.35	1.79
Neutral	Step 1[a]	religiousmean	.07	.16	.18	1	.67	1.07
		Constant	.09	.56	.03	1	.88	1.09

a. Variable(s) entered on step 1: religiousmean.

For the base rate fallacy, overall, the model was not a significant fit of the data. A test of the full model against a constant only model was not statistically significant χ^2 (1)= .13, p> .05, for the reflective priming group, for the religious priming group, χ^2 (1)= .86, p> .05 or for the neutral priming group, χ^2 (1)= .53, p> .05. This indicated that within each group religiosity was not a significant predictor of performance on the base rate fallacy.

Table 10
Omnibus Tests of Model Coefficients

reflective/religious/neutral			Chi-square	Df	Sig.
Reflective	Step 1	Step	.13	1	.72
		Block	.13	1	.72
		Model	.13	1	.72
religious	Step 1	Step	.86	1	.36
		Block	.86	1	.36
		Model	.86	1	.36
Neutral	Step 1	Step	.53	1	.47
		Block	.53	1	.47
		Model	.53	1	.47

Table 11
Variables in the Equation

reflective/religious/neutral			B	S.E.	Wald	df	Sig.	Exp(B)
Reflective	Step 1[a]	Religiousmean	.06	.17	.13	1	.72	1.07
		Constant	-.06	.59	.01	1	.92	.94
religious	Step 1[a]	Religiousmean	-.18	.19	.85	1	.36	.84
		Constant	.89	.64	1.94	1	.16	2.43
Neutral	Step 1[a]	Religiousmean	.12	.16	.53	1	.47	1.12
		Constant	-.33	.56	.35	1	.56	.72

a. Variable(s) entered on step 1: religiousmean.

CHAPTER X

DISCUSSION

A. Overview of the results

Results revealed that participants who have undergone the religious priming, through rearranging words of a religious nature, performed significantly worse than those in the reflective priming group on the conjunction fallacy only (thus, partially confirming hypothesis 2). There was no significant difference, however, between the three priming groups on the base rate fallacy and the analytic thinking task, CRT (disconfirming hypotheses 1 and 3). Similarly, no differences emerged when comparing the reflective and the neutral group on both the conjunction and base rate fallacy (disconfirming hypothesis 4).

The base rate and the conjunction fallacy, though representing different cognitive biases, both require probabilistic reasoning to arrive at the correct answer (Toplak, West, & Stanovich, 2011). Despite this, the effect of priming groups was observed only for one but not the other. A possible explanation is the order of the problems presented. The cognitive biases were presented on a single page (counter-balanced, as a unit, with the CRT), with the conjunction fallacy followed by the base rate fallacy in all cases. This may lead us to believe that the priming is only effective immediately. Since it is subtle and implicit, it may be reasonable to conclude that the priming effect was observable for the first problem only. It is also noteworthy that both problems (the base rate and the conjunction) are similar in presentation and style, with two short options given as possible answers. As a result, one can also speculate that exposure to the first problem may have made the participants more desensitized and familiar with this style of problem. This could further erase any differences that may have potentially been uncovered.

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Although there have been studies demonstrating that priming effects can, in fact, last up to 20 minutes with tasks involving semantics, studies using this particular scrambled-sentence task were more commonly followed by economic games of one-attempt only (Ahmed & Salas, 2011; Shariff & Norenzayan, 2007) and similarly a one-time cheating task (Randolph-Seng & Nielsen, 2007). This possibly reveals that, with a total of 5 *problem-solving* items, the effect may be more difficult to replicate. For example, a scrambled-sentence task followed by a 20-item tolerance of ambiguity scale, a religious convictions questionnaire of 10 items and choosing a preference for certain visual stimuli are all cases of successful priming (Sagioglou & Forstmann, 2013) but, arguably, instances in which less cognitive effort was exerted.

The same explanation can be applied for the lack of effect in the CRT. The CRT is a 3-problem task that, by nature, requires effortful thinking. As a result, individuals may require a longer time to think and respond, thereby eroding the priming effect further, especially when reaching the third and last problem. If some amount of cognitive effort was expended on the first problem of the CRT, we assume the priming effect may not have been as potent for the remaining two problems. The CRT entails numeric problems that require greater cognitive demands than answering a questionnaire on one's religious convictions, for example. Although the CRT was counterbalanced, a problem like the conjunction fallacy remains relatively simpler, containing one question with two clear options (compared with the CRT which is open-ended), making the priming effect more visible. As a result, for a presumably more difficult and longer task like the CRT, a possible suggestion would be to explore differences between groups with stronger or more explicit priming procedures. An example of a more explicit religious priming method could include writing or talking at length about religion or watching recorded religious ceremonies.

No significant relationship emerged between religiosity and the CRT. It is noteworthy, however, that there is a near significant relationship in that direction. When considering the total sample, a near-significant difference indicates, as does the literature, that higher religiosity correlates with worse performance on the CRT. More specifically, in the religious priming condition, the effect is more salient, being closer to significance than both reflective and neutral priming. The greatest level of religiosity was found in the religious priming group. As a result, this could explain the near-significant relationship between religiosity and CRT, whereby it is more easily detectable than with the other priming groups in which religiosity is lower.

Similarly, no differences were detected between religious and non-religious individuals on the conjunction and base rate fallacy. Participants' religiosity was found not to predict performance on the conjunction and base rate fallacy. This relationship has never been directly tested before, rather its presence was hypothesized based on a (positive) relationship between CRT and cognitive biases. However, cognitive biases can be different than the CRT in that they are assessing for predictable ways people err, whereas the CRT is measuring the range of a particular quality (i.e., analytic thinking).

Nevertheless, a confirmation of the hypothesis that reflective priming, compared to religious priming, can enhance performance on the conjunction fallacy indicates the powerful effects of the constructs evoked. That a subtle reminder of religiosity and analytic thought can cause a significant difference in performance on cognition is in line with previous research demonstrating the consequences of conjuring up these constructs on various tasks. Theoretically, the literature suggests that the concept of religion is made up of separate intuitive beliefs (Kirkpatrick, 2004). Thus, when religion is activated, it can supposedly influence performance on tasks that appear intuitively compelling.

The significant effect emerged while controlling for religiosity for the conjunction fallacy. In a similar study where religious priming was effective regardless of religiosity, it is explained that religious primes had activated knowledge or representation about stereotypes of religious people's goals as opposed to one's personal beliefs (Randolph-Seng & Nielsen, 2007). In other words, this was priming the perception of a certain category of people, (e.g., religious groups and their associated features in culture), and as such the effect was maintained even with individuals of low religious belief.

B. Limitations and Future Recommendations

There are two main limitations to this study. First, this study was conducted online and depended on participants completing the experiment in one sitting and with undivided attention. The priming effect would likely fail otherwise. Since participants were not monitored, we cannot be sure that they attended to the stimulus in the way that is required for the priming effect to work. For example, participants might have eaten, played with their phone, or used the internet, and thus may not have undergone the priming properly and fully. In future studies, it would be more effective to ask participants to come into the lab and complete the task while being monitored by a research assistant. Second, as mentioned above, order effects are assumed to play a part in the results. As such, counterbalancing within the cognitive biases, with a larger sample, may be necessary for clearer results.

Additional minor limitations include the lack of generalizability of the sample. A non-representative sample, in terms of age, social class, cognitive achievement, and religiosity may diminish the potency of the conclusion. Additionally, a self-report scale measuring religious convictions might have lead participants to provide only socially desirable responses, whatever they may believe them to be.

Notably, both cognitive biases were measured with a one-item test. Although this is common in the literature, a better option would be to assess their understanding of the fallacy with a number of problems and thus create a composite score. However, since priming is most effective immediately and for a brief period only, this will be difficult to carry out.

The CRT is a common measure of cognitive style and its three items are numeric. Although it demands a very basic understanding of mathematics and relies more on logic, merely having the appearance of a mathematical problem could have possibly put those who dislike numbers at a disadvantage (Ashcraft, 2002), thereby not accurately capturing their cognitive style.

This study did not consider qualitative variations in religious belief (e.g., agnosticism, deism, or spirituality). It also did not properly address religious commitment by measuring intrinsic (i.e., seeing religion as an end in itself or a more personal experience) versus extrinsic (i.e., quantity of religious involvement) religiosity, rather, it presented religion as a uniform entity. More subtle differences may emerge depending on the specific aspects of religion one adopts. In one study, only participants high on intrinsic religiosity and overtly primed with biblical verses behaved more honestly on a task (Carpenter & Marshall, 2009). It could be interesting to explore if similar differences appear on cognitive measures.

Finally, this priming task does not take into account the multifaceted and intricate nature of religious belief. The various negative and positive consequence of religious priming further highlights this fact (e.g., increase in prejudice and increase in prosocial behavior). In essence, the construct of religion itself is constituted of positively and negatively valenced concepts, most obviously: reward, punishment, heaven, and hell. As a result, religious concepts can theoretically activate a number of different values and emotions: fear, self-restriction, need for social acceptance and coherence, honesty, fairness, etc. (Harrell, 2012). It is then hypothesized that more precise distinctions in word priming can induce a particular behavior or yield a specific change in the different tasks presented (Ritter & Preston, 2013).

Three classes of religious primes: supernatural agents (e.g., god, angel), abstract/spiritual (e.g., belief, faith), and concrete (e.g., shrine, scripture) have been proposed based on a cluster analysis of the results of a pile sorting task (Ritter & Preston, 2013). This could mean that highlighting one class of primes more than the other may lead to a different set of results. Although there is no direct evidence for a one-to-one correspondence between class of religious prime and behavior, Gervais and Norenzayan (2012) note that primes of supernatural agents likely induce feelings of being watched and thus bring out greater prosocial behavior from participants. If the goal is to prime the concept of religion in general, ideally, religious primes may need to cover the three classes equally. One interesting avenue is to see further the effects of the separate classes of religious priming on specific cognitive measures.

Another way to divide religious primes would be through specific religious groups (e.g., Muslim, Christian, Druze etc.) matched to participants' faith. In the present study, care was taken to ensure that all religious words are effective to all faiths. Words from the original scramble-sentence task needed to be altered so as to be relevant to all participants. This may have made the effect less robust compared to its original form. Considering the religious diversity present in Lebanon, assessing for the effect of religious-specific primes could prove to be a more powerful prime or could produce differences in responses based on group affiliation.

The present study assessed the variance in performance on conjunction and base rate fallacy. Since a significant difference emerged, the next step would be to look for an effect on other similar cognitive biases, such as, the framing fallacy, belief bias, confirmation bias and availability bias. Separate studies can be conducted to measure the effects of priming on these biases.

Another potential study could address the effects of religious priming presented in various and more naturalistic ways. That is, religious primes could be presented in ways that are more representative of everyday life. For example, the effects of religious references in daily language, ads, billboards, personal religious symbols and dress, or simply walking past a church or a mosque on cognitive measures could be worth studying.

C. Implications

Despite the limitations, this study is nevertheless offering an interesting finding. In our immediate environment, we are bombarded with numerous external stimuli, some of which could be of religious content while others of a reflective nature. Although this study looks at the effects of semantic word priming only, religious primes are in fact rampant in our everyday life and can come in various shapes and forms. Daily exposure to religious references potentially bears cognitive consequences on thought and reasoning that are interesting to discover.

Despite having only immediate and short-lived consequences, these effects remain relevant and can have practical benefits. For instance, they can shed light on the best type of stimulus to employ depending on the environment one wishes to create. Situations in which reasoning is integral may benefit from knowing the effects of religious stimuli in the environment as well as the effects of stimuli successfully encouraging reasoning.

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Appendix A

Demographics

Age: _____

Gender: □ Male □ Female

What is your major? _____

You are a: □ Freshman □ Sophomore □ Junior □ Senior

Table A1

Religious Priming

Scrambled Sentences	Unscrambled Sentences
sacred was book refer the	the book was sacred
his worships bent idol he	he worships his idol
appreciated presence was imagine her	her presence was appreciated
more paper it once do	do it once more
send I over it mailed	I mailed it over
the poor greed pray for	pray for the poor
yesterday it finished track he	he finished it yesterday
her have in hair faith	have faith in her
a eleven was miracle it	it was a miracle
prepared somewhat I was retired	I was somewhat prepared

Table A2

Reflective Priming

Scrambled Sentences	Unscrambled Sentences
Numbers gyrate carefully analyze the	analyze the numbers carefully
yellow reason his is obvious	his reason is obvious
appreciated presence was imagine her	her presence was appreciated

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more paper it once do	do it once more
send I over it mailed	I mailed it over
they hungry options ponder their	they ponder their options
yesterday it finished track he	he finished it yesterday
day think I various all	I think all day
computers machines spend are rational	computers are rational machines
prepared somewhat I was retired	I was somewhat prepared

Table A3

Neutral priming

Scrambled Sentences	Unscrambled Sentences
appreciated presence was imagine her	Her presence was appreciated
fall was worried she always	She was always worried
shoes give replace old the	Replace the old shoes
retrace good have holiday a	Have a good holiday
more paper it once do	Do it once more
send I over it mailed	I mailed it over
rode hammer he the train	He rode the train
yesterday it finished track he	He finished it yesterday
sky the seamless blue is	The sky is blue
prepared somewhat I was retired	I was somewhat prepared

The Cognitive Reflection Task

A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the

ball cost? Intuitive answer: 10 cents, Correct answer: 5 cents.

If it takes 5 machines 5 min to make 5 widgets, how long would it take 100 machines to make

100 widgets? _____minutes. Intuitive answer: 100, correct answer: 5.

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days

for the patch to cover the entire lake, how long would it take for the patch to cover half of the

lake? _____days. Intuitive answer: 24, correct answer: 47

Conjunction Fallacy

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a

student, she was deeply concerned with issues of discrimination and social justice, and also

participated in anti-nuclear demonstrations. Which is more probable?

1. Linda is a bank teller

2. Linda is a bank teller and is active in the feminist movement.

Base Rate Fallacy

In a study 1,000 people were tested. Among the participants there were 995 nurses and five

doctors. Jake is a randomly chosen participant of this study. Jake is 34 years old. He lives in a

beautiful home in an expensive area. He is well spoken and very interested in politics. He

invests a lot of time in his career. What is more likely?

1. Jake is a nurse

2. Jake is a doctor.

Table 4

Religiosity Scale

Strongly Agree	Agree	Somewhat Agree	Neutral	Somewhat Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

I believe that God exists	1	2	3	4	5	6	7
Prayer to God is one of my usual practices	1	2	3	4	5	6	7
Religion gives me a great amount of security in life	1	2	3	4	5	6	7
I consider myself a religious person	1	2	3	4	5	6	7
My religion influences the way I choose to act in my routine life	1	2	3	4	5	6	7
I feel there are more important things in life than religion	1	2	3	4	5	6	7
I am interested in religion	1	2	3	4	5	6	7
Religious considerations influence my everyday affairs	1	2	3	4	5	6	7

Appendix B
Announcement of the Research Study
Verbal Fluency and Problem Solving

Dear Students,

The **purpose** of this research study is to examine the relationship between problem solving and verbal fluency. Problem solving is a higher-order cognitive process that requires finding the optimal solution while verbal fluency refers to verbal ability and general verbal functioning.

You are invited to participate in this study, which will be carried out online. You will be sent the link to the study, which is expected to take 20 minutes. Participants in this study must be above 18 years of age.

If you wish to participate, please contact the co-investigator, Rinad Bakhti, by email: **rsb20@aub.edu.lb.**

To thank you for your participation in the study, you will receive one credit on your final Psyc 201 grade. To earn your extra credit: You need to please copy/print the completion code and give it to your Psychology instructor who will then provide you with the extra credit. Should you decide not to participate in this study, you can choose to write a brief report on an article from a psychological journal to receive credit equivalent to 1% point added to your overall average in the course PSYC 101/201. Please contact Dr. May Awaida (mawaida@aub.edu.lb) to learn more about this option.

Primary Investigator:
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Student Researcher:
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Appendix C
Information Sheet American University of Beirut
P.O. Box 11-0236
Riad El Solh, 1107 2020
Beirut, Lebanon
INFORMATION SHEET FOR RESEARCH PROJECT

Research Project:	*Verbal Fluency and Cognition*
Project Director:	*Arne Dietrich, Ph.D.*
	Professor of Psychology, Department of Psychology, AUB
	ad12@aub.edu.lb
	01-350000 Ext. 4369
Research Investigator:	*Rinad Bakhti*
	Graduate Student of Psychology, Department of Psychology, AUB
	rsb20@aub.edu.lb
	70 227 280

*We are asking you to participate in a **research study**. Please read the information below.* **The study will be online.**

Announcements about the study could be communicated to you through your course instructors, through flyers posted on the departmental bulletin board, or on the Department's website.

Nature and Purpose of the Project:

The purpose of this study is to assess the relationship between verbal fluency and performance on problem-solving tasks. Problem solving is a higher-order cognitive process that requires finding the optimal solution whereas verbal fluency entails examining verbal ability and general verbal functioning. A total of 180 participants will be recruited for the study.

Explanation of Procedures:

As a research participant, you will have to read this information and consider carefully your participation.

It is expected that your participation in this study will not take more than 20 minutes. You will first complete the verbal fluency task and later the problem solving tasks.
Research designs often require that the full intent of a study is not explained prior to participation. Although we have described the reasons for and general nature of the tasks you will be asked to perform, the full intent of the study will not be explained to you until immediately after data collection.

Your name will be asked and your information will be kept confidential. Only the project director and the research investigator will have access to your personal data. All results will be kept in a password-locked computer in the office of the research collaborator for a

period of seven years after which the data will be permanently deleted. Only participants of age 18 and above are eligible to take part in the research.

Potential Discomfort and Risks:

There are no more than minimal risks associated with participation in this study.

Potential Benefits:

The potential benefit is that you will participate in a study that will contribute to the field of psychology. The results of this study will help understand more clearly the relationship between verbal fluency and cognition.

Costs/Reimbursements:

Your participation in this experiment incurs no costs. You will receive 1 extra point on your final Psych 201 grade upon the completion of the tasks of the experiment.

Alternatives to Participation:

Refusal to participate will involve no loss in benefit. Subjects may stop at any time without loss of benefits. Should you decide not to participate in this study, you can choose to write a brief report on an article from a psychological journal to receive credit equivalent to 1% point added to your Psyc 201 class.
You can withdraw from the study at any time and still receive the extra credit point by retaining position of the study materials.

Termination of Participation:

Should you decide to give consent to participate in this survey, the project director co-investigator might disregard your answers if the results show that you have not abided by the instructions given at the top of each set of questions.

Confidentiality:

The results of your participation will be kept <u>confidential</u> to the fullest extent possible. This means that only the project director and co-investigator will know about your specific results, which will be anonymous, as the identifying information would be linked to the data you provided up until data are analyzed. Only information that cannot be traced to you will be used in reports or manuscripts published or presented by the director or investigator. Data will be kept in a password protected computer. After the seven years have elapsed, the data will be deleted. A statement-record will be monitored and may be audited without violating confidentiality by the IRB.

Withdrawal from the Project:

Your participation in this survey is <u>completely voluntary</u>. You may withdraw your consent to participate in this research at any point without any explanation and without any penalty by clicking 'exit.'

Who to Call if You Have Any Questions:

This project has been reviewed and approved for the period indicated by the American University of Beirut (AUB) Institutional Review Board for the Protection of Human Participants in Research and Research Related Activities.

If you have any questions about your rights as a research participant, or to report a research related injury, you may call:

IRB, AUB: 01-350000 Ext. 5454 or 5445

If you have any concerns or questions about the conduct of this research project, you may contact:

Arne Dietrich: ad12@aub.edu.lb, 01-350000 Ext. 4369

Rinad Bakhti: rsb20@aub.edu.lb, 70-227 280

Consent to Participate in this Research Project:
By consenting, you agree to participate in this research project. The purpose, procedures to be used, as well as, the potential risks and benefits of your participation have been explained to you in detail. You can refuse to participate or withdraw your participation in this study at any time without penalty.
I have read and understand the above information. I agree to participate in the research study.

By clicking OK this means you are agreeing to participate in the research study.

☐ **OK**

Appendix D

Instructions: Please answer each question as honestly as possible.

1. Before the last page which asks you about religious belief, what did you think the purpose of this experiment was or was trying to study?

2. Before the last page which asks you about religious belief, did anything about the experiment seem strange to you, or was there anything you were wondering about?

3. Before the last page which asks you about religious belief, did you think that any of the different tasks were related in any way? (If yes) In what way were they related?

4. Before the last page which asks you about religious belief, did anything you did on one task affect what you did on any other task? (If yes) How exactly did it affect you?

Appendix E
American University of Beirut
P.O. Box 11-0236
Riad El Solh, 1107 2020
Beirut, Lebanon
DEBRIEFING DOCUMENT

Research Project: *The Effect of Religious and Reflective Priming on Cognitive Biases and Cognitive Style*

Thank you for participating in this research study.
We sincerely apologize for initially obscuring the real purpose of the study. Not using active deception (i.e. providing the study's real aim or simply withholding the real purpose of the study) would have been problematic. Results of laboratory experiments (as opposed to observational research) are often influenced by the fact that participants are keenly aware of their participation in controlled (psychological) research. By definition, priming aims to activate concepts implicitly, without the full awareness of the participant. Therefore, revealing the true purpose of the study will alter participants' performance on the tasks.
Deception was necessary to prevent self-presentation biases (in response to demand characteristics of the experiment) from distorting results and jeopardizing the validity of the conclusions. Simply not withholding the real aim of the study may have resulted in responses that are dependent on each participant's independent expectations regarding the true aim of the study; each participant may try to discern the real purpose of the study independently and respond accordingly.

As such, it is necessary that all participants receive uniform information ("deception") regarding the true purpose of the study. This limits the effects of confounding factors (i.e. self-presentation biases, personal expectations, and demand characteristics) from affecting participant responses differently. Therefore, active deception was not intended to embarrass anyone but to prevent distortion of results and to ensure that the validity of conclusions would not be jeopardized.

Real purpose of the study

Priming is an implicit way to make certain concepts in the mind salient. The effect of religious and reflective priming has been previously studied with a number of variables. The true aim of this study was to compare the effects of religious priming to reflective and neutral priming on cognitive style and cognitive biases.
Priming was completed through a task, in which you were asked to rearrange words of either a religious (e.g., pray), reflective (e.g., think), or neutral (e.g., paper) content. Each one of you was assigned to one of these three groups. All groups completed a slightly different version of the same task. Later, you completed problem solving tasks intended to measure your style of thinking and reasoning. The relationship between priming and thinking is assessed.

Benefits

In our immediate environment, we are bombarded with a number of stimuli, some of which are of a religious content while others of a reflective nature. Examining their effect on our daily

thinking can have practical benefits. For example, it can potentially shed light on the best type of stimulus to employ depending on the environment one wishes to create.

Questions and Concerns

If you have any other concerns or questions about your rights as a research participant, or to report a research related injury, you may contact the Institutional Review Board

Institutional Review Board, irb@aub.edu.lb, *01-350000 Ext. 5543/5540*

If you have any concerns or questions about the conduct of this research project, you may contact:

Arne Dietrich: ad12@aub.edu.lb, 01-350000 Ext. 4369

Rinad Bakhti: rsb20@aub.edu.lb, 70-227280

If you are interested in learning about the outcome of the study, you may contact Arne Dietrich and/or Rinad Bakhti (contact information above). After data analysis is completed, a summary of the results could be emailed to you upon your request.

Consent to Include Your Data in the Study:

By consenting you agree to include the data collected from you research project. The purpose, procedures to be used, as well as, the potential risks and benefits of your participation have been explained to you in detail. You can refuse to have the data collected from you included in the study and it will be destroyed immediately. You can withdraw from the study at any time and still receive the extra credit point by retaining position of the study materials.

I have read and understood the above information. I give permission to have my data used in this research project.

By clicking OK this means you are agreeing to participate in the research study.

☐ OK