

# Are Religious Affections Positive or Negative?—The Role of Religious Affections on Executive Control

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The present study investigated the influence of religious affections on executive control compared with positive and negative emotions using emotional priming paradigm and the letter flanker task. 58 participants (Tibetan Buddhists, 28 males and 30 females) were required to identify the central target letter after primed by religious, positive, or negative pictures. There was a space (loose) or no space (close) between neighboring letters. The results revealed that in close condition both religious affections-prime and negative emotional-prime reduced the flanker effect in response accuracy (ACC) compared to positive emotional-prime for female participants. It means that religious affections do not function as positive emotions on executive control. Moreover, for females, when primed by religious pictures, the ACC flanker effect was negatively related to the arousal of religious pictures, but when primed by negative pictures, the flanker effect in response time was positively related to the valence of negative pictures. The correlation analysis indicates that religious affections and negative emotions may influence executive control in different ways. These findings suggest that religious affections exert their special influence on executive control, not simply positive or negative.

*Keywords:* Religious Affections; Executive Control; Positive Emotions; Negative Emotions

## Introduction

Religion is a powerful social force that can influence social outcomes, and a psychological force that can shape human behavior. McCullough and Willoughby (2009) defined religion as cognition, affect, and behavior that derives from awareness of, or perceived interaction with, supernatural entities that are assumed to play an important role in human affairs. According to this definition, there are three psychological components of religion: religious cognition, religious affections, and religious behavior.

Most religious doctrines emphasize self-control that people must suppress certain thoughts and behaviors to align themselves with a particular set of religious standards (McCullough & Willoughby, 2009), then the links between religion and human behavior may be attributed to the influence of religion on self-regulation and self-control. Self-regulation can be broadly defined as goal-directed behaviors (Hofmann et al., 2012). Self-control, a narrower subset of self-regulatory processes, on one hand refers to behaviors to pursue the goal that conflicts with another, to counteract or override a prepotent response; on the other hand, refers to the internal resources available to inhibit, override, or alter responses (McCullough & Willoughby, 2009). Empirical researches find that religion can promote self-regulation and self-control (McCullough & Willoughby, 2009).

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Hofmann et al. (2012) outlined that successful self-regulation and self-control depended on executive control.

As to the influence of religion on self-regulation and self-control, researchers paid their attention to the influence of religion on executive control as well. Several studies revealed that religious behaviors such as meditation and prayer could promote the executive control. Tang et al. (2007) found that even for inexperienced meditations, short-term training meditation could improve their abilities to resolve mental conflict (measured with a cognitive measure called the Attention Network Test), which is an executive operation. Chan and Woolacott (2007) found that experienced mediators performed better on the Stroop task (a task with the same executive operation measured by the Attention Network Test) than inexperienced meditations did. Moreover, correlation analyses showed that Stroop effect was negatively associated with the time per day that participants reported meditating in daily life. McCullough and Willoughby (2009), Cahn and Polich (2013) reviewed neuroelectric and imaging studies about meditation, and found that, the meditation compared with control conditions produced activity increases in areas (frontal and parietal cortices, and anterior cingulate) subserving to attention and response inhibition.

In addition to religious behaviors, the priming of religious concepts also could promote executive control. Inzlicht and Tullet (2010, experiment 1) asked subjects (18 Christian, 8

Hindu, 8 Muslim, 2 Buddhist, 1 agnostic, and 1 “other”) to perform the Stroop task after consciously primed God concepts. Participants in religious-prime condition wrote a paragraph describing what their religion means and explains in their lives. In the control condition, participants wrote a paragraph of their favorite season. Theists who consciously affirmed their religious beliefs made fewer errors on incongruent Stroop trials than theists did in the control group. What’s more, implicit religious-prime also could promote executive control using Stroop task (Rounding et al., 2012: study 4). The priming task required participants to unscramble each of 10 five-word sentences by dropping an irrelevant word. In the religious-prime condition, half of the sentences contained one religious-prime word, such as God, spirit, or divine, in each sentence. In the control condition, all sentences contained five neutral words. Theists in the religious-prime condition had faster reaction times on incongruent Stroop trials than participants in control condition. These results offered supports for the link between religious beliefs and executive control.

As studies above showed, religious behaviors and the priming of religious concepts can promote self-control through executive control. However, as an important part of religion, religious affections seem to lack attention from those who are interested in links between religion and executive control.

Edwards (1746) argued that emotions are an important part of true religion, and he provided both “negative” and “positive” signs of true religious affections. Edwards (1746) noted “The holy Scriptures do everywhere place religion very much in the affection; such as fear, hope, love, hatred, desire, joy, sorrow, gratitude, compassion and zeal (p. 14)... religion lies in the affections, and maintain the contrary (p. 17)...” However, he also mentioned that love is the sum of all religion, and fountain of all other affections.

Mostly, religious affections are related to positive emotions. In recent years, numerous empirical researches have shown that religiousness is significantly associated with higher levels of life satisfaction (Blaine & Crocker, 1995) and happiness (Clark, Friedman, & Martin, 1999; Paloma & Pendleton, 1990), but with lower levels of depression (Blaine & Crocker, 1995; Idler, 1987; Koenig et al., 1988; Strawbridge et al., 1998) and anxiety (Koenig et al., 1988). Researches also revealed that, like positive emotions (Tice et al., 2007; Ren, Hu, Zhang, & Huang, 2010), religiousness could refuel self-control resource with resource depletion (Rounding et al., 2012: study 3).

Do religious affections function as positive emotions on self-regulation and self-control? It’s premature to draw a conclusion from the existing evidences and more experimental supports are needed for this opinion.

## Overview of the Experiment

In the present study, we used emotional priming paradigm and letter flanker task to investigate the influence of religious affections on executive control. We used positive, negative and religious pictures to induce emotions in the experiment. Flanker task is a typical task involved in attention control, in which stimulus-driven and goal-directed processes compete for limited attentional resources. Attention control is an executive operation regarded as one of the main “battlefields” of self-regulation and self-control (Knudsen, 2007).

The hypothesis of the experiment is that religious affections function as positive emotions on executive control. In this case

we expect that religious affections have similar influence as positive emotions on executive control. All participants were Tibetan Buddhists. As the literature showed, female Tibetan Buddhists were more religious and more active in all religious practices than male Tibetan Buddhists in China (Yang, 2011), and then the gender factor was also taken into analysis.

## Method

### Participants

58 students (28 males, 30 females) with normal or corrected-to-normal vision from Journal of Lhasa teachers college in China (mean age = 20.5 years, SD = 1.97) participated in this experiment. All the participants were Tibetan Buddhists.

### Stimuli and Procedure

Stimuli consisted of emotional pictures and flanker letters. There are 60 pictures (20 positive, 20 negative, and 20 religious). Positive and negative pictures were from the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 1999). These pictures were selected on the basis of their scores in arousal and valence. The difference between positive and negative pictures reached significance in valence, but not in arousal (valence:  $M_{\text{positive}} = 7.482$ ,  $M_{\text{negative}} = 2.428$ ,  $t = 26.46$ ,  $p < 0.001$ ; arousal:  $M_{\text{positive}} = 5.173$ ,  $M_{\text{negative}} = 5.652$ ,  $t = -1.84$ ,  $p > 0.05$ ). The religious pictures about Tibetan Buddhism were from internet. We also asked another 25 students (Tibetan Buddhists) absent in the experiment to fill out scaling test for all 60 pictures, assessing each picture’s valence, arousal, and the religious affection level (to what extent the picture can arouse your feelings for the Buddha and the Buddhism). Three types of pictures were different in valence with each other ( $ps < 0.05$ ) (see **Table 1**). As we can see, religious pictures were very positive in valence. Positive pictures’ arousal level was lower than other two types of pictures ( $ps < 0.05$ ). Religious affections level of religious pictures was higher than other two types of pictures ( $ps < 0.05$ ).

Participants were asked to perform the flanker task following emotional pictures. Angle of vision was  $0.5^\circ \times 0.7^\circ$  (width  $\times$  height) for each letter. On congruent trials, all the five letters were the same (“SSSSS”, “HHHHH”, “S SSSS”, and “H HHH H”); on incongruent trials, the central letter was different with the others (“SSHSS”, “HSHSH”, “S S H S S”, and “H H S H H”). The distance between letters had 2 levels: close (with no space between letters) vs loose (with a space between letters), such as “SSHSS” vs “S S H S S”. Participants were required to identify the central letter via key press (for half participants, pressing F for “H” and J for “S”, and half participants reverse). Participants were told to press the corresponding key as quickly and accurately as possible.

Each trial started with the presentation of fixation cross (800

**Table 1.**

Means of valence (1, negative, to 9, positive), arousal (1, calming, to 9, arousing), and religious affection (1, none, to 7 very much) assessments given by 25 students to three types of emotional pictures.

	Valence	Arousal	Religious affection level
Positive pictures	6.45	5.58	1.24
Negative pictures	2.51	6.18	1.56
Religious pictures	7.27	6.53	6.15

ms) on the center of the screen. After a blank screen (200 ms), the emotional picture was presented (1100 ms). 200 ms blank screen later, the flanker task appeared on the center of the screen with black background, and it remained visible until response. The next trial started 1100 - 130 ms after the response (see **Figure 1**). There were 2 blocks, each consisting 120 trials.

Before the beginning of the experiment, participants completed a practice block of 12 trials with neutral pictures, to ensure task instruction understanding. At the end of the experiment, participants were required to report the degree of their religious belief (from 1, irreligious, to 7, fiercely religious).

## Experimental Design

Multi-factorial design was used, with prime type, congruency between the target letter and flanker letters, distance between neighboring letters, and gender as independent variables and response time (RT) to flanker task and corresponding accuracy (ACC) as dependent variables. 3(prime type: positive, negative, and religious)  $\times$  2(congruency: congruent, incongruent)  $\times$  2(distance: close, loose)  $\times$  2(gender: male, female) repeated measure analysis of variance (ANOVA) was conducted with gender as between-group factor, and the other variables as within-group factors.

## Results

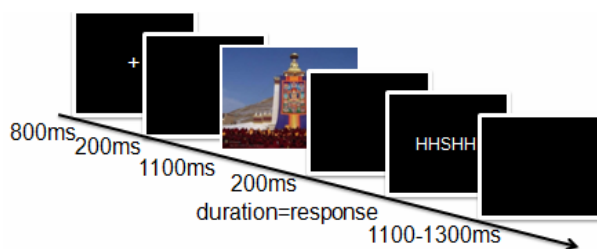
Trials with RT larger than 3000 ms were excluded from the analysis.

### RT

The RT analysis revealed a significant main effect of emotional prime type,  $F(2,112) = 38.897$ ,  $p < 0.001$ ,  $\eta^2 = 0.655$ . Further tests showed participants' response was faster in positive emotional-prime condition than in negative emotional-prime condition and religious affection-prime condition conditions ( $ps < 0.05$ ). The main effect of congruency also reached significance,  $M_{\text{congruent}} = 656$  ms,  $M_{\text{incongruent}} = 701$  ms,  $F(1,56) = 34.396$ ,  $p < 0.001$ ,  $\eta^2 = 0.381$ . Participants' responses were slower for incongruent trials than for congruent trials.

### ACC

The ACC analysis revealed a significant three-way interaction between distance, congruency, and gender,  $F(1,56) = 10.196$ ,  $p < 0.01$ ,  $\eta^2 = 0.154$ . Analysis of simple effect showed that the effect of congruency was significant in loose condition for males,  $F(1,56) = 4.228$ ,  $p < 0.05$ , and in close condition for females,  $F(1,56) = 5.872$ ,  $p < 0.05$ . The three-way interaction between the emotional prime type, distance, and congruency



**Figure 1.** Example of one trial in religious affections condition.

reached marginal significance,  $F(2,112) = 2.760$ ,  $p = 0.068$ ,  $\eta^2 = 0.047$ . Further tests showed that congruency effect was significant only in close condition when primed by positive pictures,  $F(1,56) = 7.683$ ,  $p < 0.01$ , and the ACC was larger for congruent trials than for incongruent trials.

### Flanker Effect

We also calculated the flanker effect (the size of interference of the flanker letters to the target letter) for RTs and ACCs (see **Table 2**),  $RT_{\text{incongruent}} - RT_{\text{congruent}}$ ,  $ACC_{\text{congruent}} - ACC_{\text{incongruent}}$ . A 3(emotional prime type: positive, negative, and religious)  $\times$  2(distance between neighboring letters: close, loose)  $\times$  2(gender: male, female) repeated measures ANOVA was performed for RT and ACC flanker effects. The analysis of RT flanker effects didn't find any significant effect. The analysis of ACC flanker effects showed that the interaction between distance and gender was significant,  $F(1,56) = 10.196$ ,  $p < 0.01$ ,  $\eta^2 = 0.154$ .

Then we analyzed ACC flanker effects for males and for females respectively. A 3(emotional prime type: positive, negative, and religious)  $\times$  2(distance: close, loose) repeated measures ANOVA was conducted. For males, the analysis found no significant main effect or interaction ( $ps > 0.05$ ). For females, the main effect of emotional prime was significant,  $F(2,58) = 3.518$ ,  $p < 0.05$ ,  $\eta^2 = 0.108$ . Further tests showed that the ACC flanker effect in positive emotional-prime condition was larger than in religious affection-prime condition ( $p < 0.05$ ) and negative emotional-prime condition ( $p = 0.072$ ). The main effect of distance between letters was significant,  $F(1,29) = 7.602$ ,  $p < 0.05$ ,  $\eta^2 = 0.208$ , and the ACC flanker effect in close condition was larger than in loose condition. In addition, the interaction between emotional prime and distance reached marginal significance,  $F(2,58) = 2.993$ ,  $p = 0.058$ ,  $\eta^2 = 0.094$ . Analysis of simple effect showed that the effect of emotional prime was significant only in close condition,  $F(2,28) = 4.788$ ,  $p < 0.05$ ,  $\eta^2 = 0.255$ . The ACC flanker effect was larger in positive emotional-prime condition than in other two emotional priming conditions ( $ps < 0.05$ ), but the difference of ACC flanker effects between negative emotional-prime condition and religious affection-prime condition failed to reach significance ( $p > 0.05$ ). The ACC flanker effect under positive emotional-prime condition was mediated by distance between letters,  $F(1,29) = 10.954$ ,  $p < 0.01$ ,  $\eta^2 = 0.274$ , and ACC flanker effect in close condition was larger than in loose condition.

In order to further compare the religious affection-prime with negative emotional-prime, a correlation analysis was conducted. For females, in close condition, when primed by negative pictures, the RT flanker effect was positively related to the valence of pictures,  $r = 0.518$ ,  $p < 0.05$ . On the contrary, when primed by religious pictures, the ACC flanker effect was negatively related to the arousal of pictures,  $r = -0.491$ ,  $p < 0.05$ . Put negative and positive pictures together (40 pictures), for females the ACC flanker effect in close condition was positively related to the valence of pictures,  $r = 0.322$ ,  $p < 0.05$ . We also found that the degree of participants' religious belief they reported themselves after the experiment was negatively related to the RT flanker effect in close condition when primed by religious pictures,  $r = -0.261$ ,  $p < 0.05$ , the stronger their faith, the smaller the flanker effect.

## Discussion

In the experiment, the letter flanker task provides us an opportunity to investigate the impact of religious affection, positive and negative emotions on executive control.

First, results showed that, for females, in close condition, the ACC flanker effect in positive emotional-prime trials was larger compared with negative emotional-prime trials. The ACC flanker effect in positive and negative emotional-prime trials was positively related to the valence of pictures but not arousal. These findings are compatible with the broaden-and-build theory (Fredrickson, 1988, 2001) that positive emotions broaden the scope of attention and thought-action repertoires, and negative emotions narrow the scope of attention and thought-action repertoires. When the attention scope is broadened, the interference of flankers to target letter increases, resulting in flanker effect increasing; and when the attention scope is narrowed, the flanker effect decreases with the interference reduced (Fenske & Eastwood, 2003; Fredrickson & Branigan, 2005; Rowe et al., 2007). That is also why only in positive emotional-prime trials ACC flanker effect was modulated by distance between letters, larger in close condition.

Second, the most exciting finding is that, religious affection is a kind of emotion that different with positive and negative emotions. It has its own special effect on executive control, which is opposite to our expectation that religious affections function as positive emotions on executive control. Results revealed that for females in close condition, compared to positive emotional-prime the religious affections-prime reduced the ACC flanker effect. This finding indicated that religious affections would not function as positive emotions on executive control. As results shown, negative emotional-prime and religious affections-prime had no difference in the size of flanker effect. Does it mean religious affections function as negative emotions in flanker task? Our results showed that the flanker effect was negatively related to the arousal of pictures in religious affections-prime condition whereas the flanker effect was positively related to the valence of pictures in negative emotional-prime condition. This result suggests that religious affections and negative emotions may do work in different ways on executive attention.

It was reported that religion influences self-regulation and self-control by influencing people's goals. Religion may increase people's motivation to obtain goals by sanctifying them, or endowing them with a sacred significance (McCullough & Willoughby, 2009). Then the goals can obtain more mental resource. Maybe, that's why religion can refuel self-control resource with and without resource depletion (Rounding et al., 2012: study 3). We infer that religious affection provides more mental resource for the flanker task to override the interference from flanker letters. The impact of positive and negative emotions on executive attention has nothing to do with the goal. The scope of attention is broadened by positive emotions, and was narrowed by negative emotions.

In addition, in close conditions, the degree of participants' belief reported by themselves was negatively related to the RT flanker effect in religious affection-prime condition only, the stronger their faith, the smaller the flanker effect. The religious affection derives from the interaction with "supernatural entities". Religious affections are based on the religious belief, the stronger their faith, the more potent their religious affections. To some extent, this finding adds the evidence that religious

affections can reduce the interference from flanker letters.

Finally, there was no significant effect of emotional-prime on executive control for males. We can explain this result from the following aspects. In the first place, the sex difference of the perception of the emotional stimuli (Hall, 1978; Montagne et al., 2005; Hofer et al., 2006) may contribute to this result. Females are more sensitive to the emotional stimulus, especially to the negative emotional stimulus (Hall, 1978; Montagne et al., 2005; Scholten et al., 2005; Hofer et al., 2006). Secondly, for Tibetan Buddhism, female Tibetan Buddhists were more religious and more active in all religious practices than male Tibetan Buddhists in China (Yang, 2011), then the religious affections induced by religious pictures are weaker for male participants than female participants. At last, when performing cognitive tasks, the emotions seem to have more influence on women's performance. Koch et al. (2007) asked participants to perform an n-back verbal working memory task, and fMRI analysis revealed that in women the interaction of verbal working memory and negative emotions was associated with more emotion-associated areas (amygdala and the orbitofrontal cortex) whereas in men regions (prefrontal and superior parietal regions) commonly regarded as important for cognition and cognitive control were activated.

## Limitation and Future Directions

The limitation of the current study was the lack of a control group. All participants of the study were Tibetan Buddhists. As all Tibetans in China are Tibetan Buddhists, we can't recruit Tibetan participants without religious belief. Therefore, with a non-Tibetan control group we can't separate the ethnic factor and the religious belief factor. As a remedy, we conducted the correlation analysis between the level of participants' religious belief and flanker effects.

Future studies examining the influence of religious affections on attention control may benefit from using eye-tracker. From the current study, we only know that religious affections exert different influence on attention control compared with positive and negative emotions, but we are not clear of the mechanism in which religious affections modulate the scope of attention. It can be figured out by using eye-tracker.

## Conclusion

In close condition, we found a reliable modulation of flanker effect by the emotional-prime in female participants. Religious affections-prime and negative emotional-prime reduced the ACC flanker effect compared to positive emotional-prime, but there was no significant difference of ACC flanker effect between religious affection-prime and negative emotional-prime conditions. Correlation analysis revealed that the ACC flanker effect was negatively related to the arousal of pictures in religious affection-prime condition whereas the RT flanker effect was positively related to the valence of pictures in negative emotional-prime condition. These findings from the experiment suggest that religious affections exert their special influence on executive control. Religious affections are emotions based on religious belief, not simply positive or negative.

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