AUTOMATIC EMOTION-SPECIFIC EFFECTS OF

EMOTION-REPRESENTATIONS ON AGENCY APPRAISALS

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SUMMARY

Previous researchers have demonstrated that different emotions colour cognitive processes in specific ways, and that even subliminally presented emotional cues, such as negative and positive facial expressions, influence cognitive processes. However, few have investigated the automatic and unconscious effects of emotional cues on cognitive processes in a way that goes beyond valence. To fill this research gap, this study investigated the impact of subliminally presented emotional cues on the cognitive process of appraisal by subliminally presenting angry and sad facial expressions to participants and examining their impact on the participants' causal appraisals. Analysis revealed that the appraisals had been influenced by unconsciously activated emotion-representations in a manner in accordance with appraisal theories of emotion. Participants primed with angry faces were more likely to appraise other individuals and less likely to appraise interpersonal factors as the agency for negative events compared to those primed with sad faces. As these effects were confined to negative events, they suggest the existence of a valence-congruent effect. Subjective feelings of anger and sadness were not affected by the facial primes. Theoretical importance of these findings, the limitations of the study, and possible directions for further research are discussed.

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CHAPTER 1

INTRODUCTION

In a landmark study, Zajonc (1980) demonstrated that basic affective reactions, such as preferences regarding individual likes and dislikes, can be automatically evoked by minimal stimulation, such as subliminally presented facial expressions and affective adjectives. The multitude of subsequent research into automatic unconscious affective reactions triggered by Zajonc's findings has provided evidence that various cognitive functions can be affected by subliminally presented emotional primes (e.g., Chartrand, Van Baaren, & Bargh, 2006; Murphy & Zajonc, 1993; Stapel, Koomen, & Ruys, 2002). Specifically, researchers have found that subliminally presenting positive words (e.g., music), as compared to subliminally presenting negative words (e.g., bombs), produces positive interpretations in subsequent unrelated tasks, including defining homographs, categorizing ambiguous objects, and making judgments regarding personality traits (Ferguson, Bargh, & Nayak, 2005). Likewise, many researchers have found that individuals exposed to subliminally happy facial expressions rather than subliminally angry facial expressions tend to rate subsequently presented news messages as more positive, as well as show more trustworthiness and memorize more positive messages (Ravaja, Kallinen, Saari, & Keltikangas-Jarvinen, 2004). However, such research has only demonstrated the existence of *unconscious valence-based effects* (i.e., cognitive processes varying as a function of subliminally presented positive versus negative primes). No research has examined whether these unconscious effects could be emotion-specific or, in other words, whether

differential effects on cognitive processes could be evoked by subliminal emotional primes of the same valence.

The existence of unconscious emotion-specific effects is theoretically feasible. Emotions are considered an adaptive system designed to rapidly extract emotional information or signals beyond global valence and automatically activate corresponding responses to cope with various challenges. Partially supporting this perspective, numerous researchers have demonstrated that emotions of the same valence can activate different cognitive functions (e.g., Bodenhausen, Sheppard, & Kramer, 1994; DeSteno, Petty, Wegener, & Rucker, 2000; Keltner, Ellsworth, & Edwards, 1993; Lerner & Keltner, 2001). For instance, Raghunathan and Pham (1990) found that individuals induced to feel sad tend to make more high-risk decisions, while individuals made to feel anxious tend to make more low-risk decisions. Because these researchers induced conscious emotional experiences, they made no demonstration of whether the effects of emotions or emotional stimuli on cognitive functions could be subliminally elicited. Thus, the present study aimed to fill this research gap by providing the first evidence demonstrating the unconscious emotion-specific effects of emotional stimuli on cognitive processes. By doing so, this study broadened research into the effects of emotions on cognitions by demonstrating that emotional stimuli of the same valence can unconsciously and differently influence the cognitive process of appraisal. The findings of this study also should further support appraisal theories of emotions by demonstrating that appraisals are influenced by subliminally presented emotional stimuli in a manner predicted by appraisal theories.

Appraisal theories of emotion propose that each emotion is associated with a unique pattern of cognitive appraisals (Ellsworth & Scherer, 2003). For example, the

appraisal theory of emotion associates sadness with appraisals of unpleasantness and under situational control and associates anger with appraisals of unpleasantness and brought by other individuals (Smith & Ellsworth, 1985). Drawing from appraisal theories, this study tested the hypothesis that a subliminally activated anger representation would facilitate attributions to other individuals but that a subliminally activated sadness representation would facilitate attributions to uncontrollable interpersonal circumstances.

The Adaptive Emotional System

Emotions are posited to be a multi-component adaptive system designed to address specific environmental contingencies (Ekman, 1984; Frijda, 1988; Keltner & Gross, 1999; Scherer, 1984). This emotional system should be capable of activating distinctive responses that accord with the unique challenges posed by different situations. However, in circumstances that demand a rapid response, little time is available to engage in controlled cognitive processes necessary to develop and implement an action plan. In such situations, it is more adaptive to react automatically, even if awareness is momentarily sidelined for an evolutionarily or culturally scripted response to be activated.

This functional perspective on emotions holds two critical implications for research into emotion. One implication is that an emotional system should be sufficiently sophisticated to rapidly extract fine-grained information signifying specific emotional stimuli (e.g., facial expressions and voice) such that a response tailored to the stimuli can be made. An adaptive system with this level of sophistication should not only be capable of discriminating information by valence but also be sensitive to the detailed differences among emotional stimuli of the same

valence (e.g., sadness, fear, and anger). Such sensitivity to the incoming stimuli at the emotion-specific level allows output responses associated with specific emotions to be elicited rather than responses associated with broad positive or negative affect. This sensitivity may be especially important in differentiating between negative emotional information. For example, whereas sadness-related information could signal misfortune, which in turn could elicit empathic responses, fear-related information could suggest danger, which in turn could elicit a flight-or-fight response. Appropriate responses should be rapid and automatic in order to aid survival. The other implication is that unconscious emotional responses are possible (Lazarus, 1991; Zajonc, 1980). In support of this implication, research has shown that emotional responses (e.g., cognitive processes, autonomic responses, communicative expressions, and subjective experiences) can be activated by mere exposure to subliminally presented affective stimuli (Murphy & Zajonc, 1993), even without conscious experience of the corresponding emotions (Bargh & Chartrand, 1999; Winkielman & Berridge, 2004).

These implications in turn suggest that responses associated with specific emotions, including appraisals, can be activated by emotional cues below conscious thresholds although the prevailing view is that subliminally presented stimuli cannot extract more than basic valence-based emotional responses (Murphy, 2001; Zajonc, 2000).

Effects of Emotion on Cognition

Research has examined the impact of emotions on a remarkable array of cognitive processes. Compared to negative emotions, positive emotions are not just more likely to produce positive attitudinal judgments of individuals and non-human

objects (e.g., Forgas & Moylan, 1987; Friedman, Rubin, Jacobson, & Clore, 1978; Gouaux, 1971; Isen, Shalker, Clark, & Karp, 1978) but also more likely to evoke stereotypic responses (Bodenhausen, Kramer, & Susser, 1994), endorsement of peripheral cues in persuasion (Mackie & Worth, 1989), usage of scripts (Bless et al., 1996) and abstract categories (Gasper & Clore, 2002; Isen & Daubman, 1984), and correspondence biases (Forgas, 1998). In contrast, negative emotions, particularly sadness, are more positively associated with analytical thinking (Melton, 1995), change in attitudes based on argument strength (Bless, Bohner, Schwarz, & Strack, 1990), and usage of diagnostic information in judgment and decision making (Edwards & Weary, 1993; Hildebrand-Saints & Weary, 1989).

However, these studies have only revealed how cognitive functions might differ as a function of affective valence (i.e., the effects of positive versus negative affect on cognitive processes). Emotions are known to be more complex, with each emotion associated with distinct cognitive functions (Ekman, 1984; Roseman, 1984; Scherer, 1984; Smith & Ellsworth, 1985; Tomkins, 1962). Further, the perspective that individual emotions are evolutionarily scripted with unique adaptive responses (Frijda, 1988; Keltner & Gross, 1999) implies that the cognitive consequences of specific emotions should differ, even if these emotions do not vary in valence. Supporting this idea, emotions of the same valence (e.g., sadness and anger) have been found to produce different effects on, for example, causal judgments (Keltner et al., 1993), likelihood estimates (DeSteno et al., 2000), stereotypic responses (Bodenhausen, Sheppard et al., 1994), risk perceptions (Fischhoff, Gonzalez, Lerner, & Small, 2005; Lerner, Gonzalez, Small, & Fischhoff, 2003; Lerner & Keltner, 2001), systematic versus heuristic processing (Tiedens & Linton, 2001), and

intergroup judgments (Dasgupta, DeSteno, Williams, & Hunsinger, 2009; DeSteno, Dasgupta, Bartlett, & Cajdric, 2004).

The emotions in all these studies, however, were manipulated by using conscious emotion-induction techniques (e.g., recalling personal experiences, reading vignettes, listening to music, and watching films) in which participants could assess their emotions, and even locate their sources. Therefore, their findings only revealed that emotions that are consciously experienced can produce residual effects on cognitive processes, not whether emotion-representations can be unconsciously primed and still influence cognitive processes while remaining inaccessible to awareness.

There are theoretical reasons to expect that subliminally primed emotion-representations can affect cognitive processes. First, the effects of emotional primes on cognitive processes can be unintentional, unconscious, and often uncontrollable (Bargh, 1994). Emotions and their cognitive concomitants are associatively represented in memory such that the presence of a matching cue can activate the emotion-cognition network (Bargh & Chartrand, 2000; Lang, 1993; Leventhal, 1982), with repeated co-activation making the process increasingly automatic. Over time, activation of the network can be initiated even with subliminal cues, setting off the same emotion-to-cognition sequence as would a conscious operation, but without awareness or deliberate control (Bargh & Chartrand, 1999). This implies that subliminally presented emotional primes can automatically activate specific cognitive processes.

Second, research has provided empirical evidence of unconscious emotion-to-cognition processes. In one study, participants subliminally exposed to positive prime words exhibited less systematic processing but more heuristic processing than

those subliminally exposed to negative prime words (Chartrand et al., 2006). Another study found that subliminal presentations of happy faces produced more favourable evaluation of novel targets than subliminal presentations of angry or sad faces (Murphy & Zajonc, 1993; Stapel & Koomen, 2006; Stapel et al., 2002). These findings have been corroborated by studies showing that parallel neurological activation is elicited by subliminally presented affective facial primes. For example, subliminally presented fear faces have been found to lead to not only more negative evaluations but also activation of larger occipital P1 potentials, which are usually enhanced by threatening visual stimuli, as compared to subliminally presented happy facial primes (Li, Zinbarg, Boehm, & Paller, 2008).

However, despite their impressive demonstrations of the unconscious effects of emotional primes on various cognitive processes, these studies only compared the effects of positive emotional primes to negative emotional primes, and none investigated whether such cognitive processes can also be discriminately influenced by subliminally presented cues associated with emotions of the same valence.

This research gap calls for investigation into emotion-specific cognitive effects and unconscious elicitations of emotional responses. To maintain a state of unconscious awareness during investigation, subliminal priming is used to ensure that participants have no awareness of the primes or their influence on cognitive responses.

To the best of the author's knowledge, only two studies came closest to examining the existence of unconscious emotion-specific cognitive effects. Ruys and Stapel (2008b) examined the effects of subliminally presented pictorial cues related to fear and disgust, but did not find evidence of the differentiated activation of fear and disgust concepts (in a word-fragment task). Zemack-Rugar, Bettman, and

Fitzsimons (2007) found that subliminally presented guilt primes elicited fewer indulgence behaviours (allotting money for personal consumption) but more helping behaviours (assisting a charity) than subliminally presented sadness primes. Although Zemack-Rugar et al. provided important evidence of the existence of unconscious emotion-specific *behavioural* effects, their study did not provide evidence of the existence of unconscious emotion-specific *cognitive* effects, such as effects on appraisals.

To address this lack of evidence regarding emotion-specific effects, this research examined whether subliminally presented anger-related and sadness-related cues can discriminately affect appraisals associated with anger and sadness, respectively. The following section reviews the literature regarding appraisal theories and discusses the predictions regarding the emotion-specific effect of emotional stimuli on appraisals.

Appraisal Theories and Automatic Appraisal Processes

Although valence is by far the strongest differentiator of emotions (Smith & Ellsworth, 1985), models based on valence are unable to make fine distinctions among emotions of the same valence. Specifically, valence-based models can predict how positive emotions and negative emotions differently colour subsequent cognitive processes or behaviours but cannot predict the differential effects of emotions of the same valence. Because they can predict how different emotions of the same valence (e.g., anger versus sadness) might influence distinctive cognitive processes, appraisal theories of emotion provide considerable utility over valence-based models.

Although there are several different appraisal theories in the literature[1], they all agree on the fundamental proposition that each emotion is activated by and associated with a specific pattern of appraisal dimensions, including pleasantness (how pleasant/unpleasant the stimulus is), control (how much control one has over the stimulus), agency (who or what is responsible for causing the stimulus), certainty (how certain/uncertain the future is), and moral violation (whether the stimulus violates moral or social rules). While valence can only differentiate between positive and negative emotions as a whole, it is only by appraisal of these additional dimensions, such as agency and certainty, that one can differentiate a variety of emotions (Ortony, Clore, & Collins, 1988; Roseman, 1984; Smith & Ellsworth, 1985; Smith & Lazarus, 1990). For example, anger can be provoked when events are appraised as undesirable and caused by other individuals (i.e., the agency is other individuals) and sadness can be elicited by appraising the same undesirable events as caused by uncontrollable impersonal circumstances (i.e., the agency is the situation).

Numerous studies have shown that specific patterns of appraisals can activate corresponding emotional responses, as predicted by appraisal theories (Frijda, Kuipers, & ter Schure, 1989; Roseman, 1991; Roseman, Antoniou, & Jose, 1996). For instance, when asked to recall negative experiences caused by another person, individuals are more likely to report feeling anger; when asked to recall negative events caused by nonhuman factors, they tend to report feeling sadness; and when asked to recall negative events caused by the self, they tend to report feeling guilt (Ellsworth & Smith, 1988). Supportive evidence for these phenomena has been obtained in both laboratory conditions (Smith & Lazarus, 1993) and

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[1] Not all appraisal theories agree regarding which appraisal dimensions are important for particular emotions (Moors, 2009; Scherer, 1999).

naturalistic environments (Scherer & Ceschi, 1997; Smith & Ellsworth, 1987; Tong et al., 2005, 2007).

Just as appraisals can elicit specific emotions, emotions can activate specific appraisals. In one study, Keltner et al.(1993) induced feelings of sadness or anger among the participants either by having them read anger- or sadness-inducing vignettes or by having them form the corresponding angry or sad facial expressions. Those participants induced to fear anger, either by reading a vignette or forming the corresponding facial expression, were more likely to appraise subsequent unrelated events as caused by other individuals, whereas those participants induced to feel sadness were more likely to appraise them as caused by uncontrollable situational factors. In another research, Lerner and Keltner (2001) found that participants induced to feel fearful by means of recalling past fearful experiences were more likely to perceive upcoming events as uncertain and make pessimistic predictions than those who were induced to feel angry. Lerner and Keltner's findings supported the supposition of appraisal theories regarding the differences between fear and anger on the appraisal dimension of certainty that people feeling fear tend to perceive less certainty and those feeling angry tend to perceive more certainty.

These studies indicate that conscious emotional experiences can induce an appraisal tendency that pervades different situations. That is, the appraisal of an event is systematically affected by carry-over effects from a previous emotional experience. Because appraisal theories postulate fine differences in appraisals between emotions of the same valence, such as the difference in agency between anger and sadness, the effects of emotions on appraisals as predicted by appraisal theories include not only valence-based effects but also emotion-specific effects. Therefore, the *appraisal tendency*, which is a consequence of a previous emotion, is

richer than a simple valence-based evaluation, as it also incorporates complex appraisal dimensions (e.g., agency) associated with that emotion.

Appraisal theorists do not only regard appraisals as consciously performed processes. In fact, one consensus among the many appraisal theorists is that emotion-related appraisal processes are predominantly rapid and unconscious (Frijda, 1993; Scherer, 2004; Smith, Haynes, Lazarus, & Pope, 1993; Smith & Kirby, 2000; Smith & Lazarus, 1990). Arnold's (1960) conceptualization of appraisals as "direct, immediate, [and] intuitive" evaluations influenced subsequent theorists, most of whom argue that appraisals can be automatically activated. For example, Smith and Kirby (2000) proposed that appraisals can be efficiently and often unconsciously activated by priming and associative processes (see also Clore & Ortony, 2000; Leventhal & Scherer, 1987). Emerging evidence also indicates that simple appraisals, such as appraisals of valence and motivational congruence, can be computed online in an automatic manner (Grandjean & Scherer, 2008; Moors & De Houwer, 2001; Moors, De Houwer, & Eelen, 2004).

Although numerous studies have demonstrated that appraisals can be influenced by conscious emotional experiences, none has determined whether specific appraisals can also be automatically elicited when emotion-representations are activated unconsciously. In fact, this defect is emblematic of appraisal research in general. Except for a small number of studies that examined automatic appraisal activation (Grandjean & Scherer, 2008; Moors & De Houwer, 2001; Moors et al., 2004), most appraisal studies have neglected researching automatic appraisal-emotion processes, although appraisal theorists have posited their existence (e.g., Ekman, 1992; Lazarus, 1991; also see Smith & Kirby, 2000, for an in-depth account of automatic appraisal processes). Research is clearly needed to determine whether

emotions can affect appraisals in the absence of individual cognizance of any emotional feelings or their antecedents, as predicted by appraisal theories. This study aims to conduct just such research.

Summary and Overview of the Present Research

Current understanding of emotions as an adaptive system implies that this system should be able to automatically extract information from a situation beyond simply valence and elicit emotion-specific responses, even when this emotion-related information is subliminally presented. However, previous studies that found evidence of emotion-specific cognitive effects did not investigate unconscious effects, while studies that found evidence of unconscious cognitive effects did not investigate emotion-specific effects (e.g., Chartrand et al., 2006; Murphy & Zajonc, 1993; Stapel et al., 2002).

Appraisal theories of emotion predict that emotions of the same valence might activate distinctive and specific cognitive processes. Although previous studies have demonstrated the effects of conscious emotional feelings on appraisals (Keltner et al., 1993; Lerner & Keltner, 2001), no study has examined whether the emotion-specific effects on appraisals could be unconsciously elicited by subliminally presented emotional primes. To fill this research gap, the present study aimed to provide the first evidence of the existence of unconscious emotion-specific cognitive effects on appraisals. To do so, the researcher conducted two experiments manipulating emotion-related information and agency appraisals as dependent variables to determine whether subliminal presentations of anger and sadness stimuli would differentially activate the corresponding agency appraisals. The researcher selected the emotions of anger and sadness for analysis for two primary reasons.

First, it is well recognized that the dimension of agency is a central discriminator between anger and sadness (Ellsworth & Smith, 1988; Keltner et al., 1993; Smith & Ellsworth, 1985). This consensus allows for predictions of differences regarding appraisals of agency as a function of these two emotions. Second, recognition of anger and sadness is a universal (Ekman, 1993; Elfenbein & Ambady, 2002).

Participants were asked to evaluate several Korean words and as they were doing so, they were subliminally primed with angry or sad faces. Next, they were asked to describe what they thought were the causes of several events in an open-ended format. After they had done so, they were asked to rate the degree to which they were experiencing feelings of anger or sadness. Drawing from appraisal theories of emotion, the following hypotheses were proposed: subliminally activated anger representations would elicit more Agency-Others appraisals than subliminally activated sadness representations; conversely, subliminally activated sadness representations would elicit more Agency-Situation appraisals than subliminally activated anger representations. Past research indicates that subliminally presented emotion-related stimuli tend not to affect self-reported emotions (e.g., Ruys & Stapel, 2008b; Winkielman, Berridge, & Wilbarger, 2005); Zemack-Rugar, Bettman, & Fitzsimons, 2007). Hence, it was also predicted, as a secondary hypothesis that the subliminal facial primes would have no effect on the self-report ratings of current feelings of anger and sadness, and that the participants would not experience strong angry or sad feelings. Finding support for these hypotheses would indicate that emotion-specific appraisals can be automatically and unconsciously elicited by subliminally presented emotional primes, even without experiencing the corresponding emotions.

Facial primes were used as cues in the current study for several reasons. First, because emotional expressions have important communicative functions (Ekman, 1984), they approximate the social environment more closely than other stimuli, such as affective adjectives, when used as primes. Second, subliminally presented facial primes have been shown to be effective primes, producing predicted changes in many psychological and physical processes(De Gelder, 2005; Ravaja et al., 2004). For instance, researchers have found that evaluation of novel stimuli (e.g., Chinese ideographs) can be shaped by subliminally presented facial expressions, with happy faces tending to lead to more favourable evaluation and angry or sad faces to more negative evaluation (Murphy & Zajonc, 1993; Rotteveel, de Groot, Geutskens, & Phaf, 2001; Winkielman, Zajonc, & Schwarz, 1997). Facial primes have been demonstrated to influence consumption behaviours. For example, Winkielman et al. (2005) found that thirsty participants consume a greater quantity of a beverage when they were subliminally primed with happy faces than with angry faces. Third, studies employing facial electromyographic measures have shown that individuals unintentionally and spontaneously mimic the facial expressions to which they are exposed, regardless of whether the facial expressions are presented within their range of consciousness (Dimberg, 1990; Dimberg, 1997; Dimberg, Thunberg, & Elmehed, 2000; Ichikawa & Makino, 2004). Thus, subliminal angry and sad faces would be expected to activate anger and sadness representations, respectively, which should in turn elicit related responses.

Because asking close-ended questions (e.g., "To what extent is this event caused by another person?") can prime and restrict participants' responses, this means of measuring appraisal—the typical means of measuring appraisal in past studies—was not used in this research. Specifically, an appraisal that had never been

activated might be rated erroneously as present because participants were led by the wording of the item to mistakenly believe that an appraisal had been made. In contrast, open-ended items encourage response spontaneity and variability, allowing participants to more freely provide their appraisals with minimal contextual influence from close-ended items. The participants' open-ended responses were coded and analyzed to determine whether they had made Agency-Others or Agency-Situation appraisals. Similar methods were used to investigate a variety of constructs, such as stereotypes, positive emotions, and interpersonal behaviours (Danner, Snowdon, & Friesen, 2001; Forgas, 1999; Macrae, Bodenhausen, Milne, & Jetten, 1994), and the same method was once employed to assess appraisals (Yap & Tong, 2009).

CHAPTER 2

EXPERIMENT 1

Method

Participants

Sixty-eight undergraduate students of Chinese ethnicity (52 females, mean age = 20.13, *SD* = 1.35) from the National University of Singapore (NUS) voluntarily participated in the study to earn one course credit. Half the participants were randomly assigned to the Sadness Prime condition and half to the Anger Prime condition.

Design

Experiment 1 was a mixed-design study including one between-subject independent variable (IV) (Prime) with two levels (Anger Prime and Sadness Prime) and one within-subject IV (Agency) with two levels (Agency-Others and Agency-Situation). The dependent variable (DV) was the number of Agency responses.

Procedure

Upon arrival, each participant was assigned to a partitioned computer terminal in which she or he was seated approximately 50 cm from the computer screen. All tasks were administered on Dell X-series desktop computers with a monitor refresh rate of 75 Hz and an Intel GMA 3000 graphic card with memory capability up to 256 MB. The entire experiment was administered using DirectRT Precision Timing software (Jarvis, 2008).

The participants were told that they would participate in several unrelated studies. Although the first task was presented as an examination of their intuitive judgment of novel stimuli, in this case words in Korean, a language with which none of the participants was familiar, their responses to this task were not of interest, with the task only being used as means of covertly administering the facial primes. The participants were given a cover story to explain why they were asked to perform an apparently strange task. The participants were told that even if people could not understand a language, they could intuitively infer the meaning of words in a language that they did not know based on certain features, such as the shape of the characters and this study aimed to test the accuracy of such intuitive judgment. In each trial, the participants were presented with a Korean word composed of two characters and asked to indicate whether that word had a positive meaning or a negative meaning. After engaging in five practice trials, the participants engaged in 50 main trials, all of which followed the same procedure.

The priming procedure was based on a procedure that had been used in similar studies (e.g., Bargh, Chen, & Burrows, 1996) adapted to fulfill the research objective. In each trial, the participants were told to focus on a fixation point (+) presented for 1000 ms at the centre of the computer screen, allegedly because the point signalled the start of a new trial and would help them to prepare for the coming stimulus. This instruction ensured that the participants were attending to the screen when the prime was presented. After the fixation point had been presented, a forward mask comprised of diagonal cross-hatches on a grey background was presented for 200 ms. Next, a facial prime was presented; across the 50 trials, half of the primes were male and half were female. Participants assigned to the Anger Prime condition were exposed only to angry facial expressions and those assigned to

the Sadness Prime condition were exposed only to sad facial expressions. The exposure time for the primes, which ranged from 26 ms to 28 ms, was determined by the 75 Hz monitor refresh rate and the video graphic card capability. The presentation of a facial prime was followed by the presentation of a backward mask comprised of a wall of "&" symbols distributed uniformly over a gray background presented for 200 ms.

A Korean word (e.g., 의 자; see Appendix A for all Korean words) was then presented for 3000 ms[2]. In the meantime, the participants rated the word using a seven-point scale that ranged from 1 *(extremely negative meaning)* to 7 *(extremely positive meaning)* using the numerical keypad. After they had rated the word or 3000 ms had elapsed, the next trial was activated. Each Korean word was presented only once across the 50 trials. Each word was presented for at most 3000 ms to prevent the participants from spending too much time on each trial. If the time spent on the priming procedure had varied widely across participants, the different temporal delays might have led to different strengths of the priming effect (Higgins, Bargh, & Lombardi, 1985; Kandel, 1976). The facial primes and Korean words were presented in a randomized manner across participants, as configured by DirectRT.

After this priming procedure, the participants proceeded with the agency measure. In each of the 10 trials, the participants were presented with one sentence that described a hypothetical negative life event and asked to indicate what they thought was the most likely cause of each event in one brief sentence, with the event sentence remaining on the screen until they had responded. The participants were

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[2] Consistent with past studies, the chosen Korean words were affectively bland (e.g., Murphy & Zajonc, 1993). In a pilot study, a sample of twenty NUS undergraduates who did not participate in Experiment 1 rated each word on a 7-point scale ranging from 1 (*do not like the word at all*) to 7 (*like the word quite a bit*). All ratings were not significantly different from the mid-point of the scale, all $|t|$s < 1.75, dfs = 19, ps > .05.

told that there were no right or wrong answers and that they should provide the first cause that came to mind. The 10 events were presented in random order across participants. After completing the agency measure, the participants were asked to rate how angry and sad they were at the moment and whether they could read Korean. All participants indicated that they could not read Korean.

The debriefing held after the experiment indicated that none of the participants thought that the two tasks were related and that none had knowledge of the true research objective. The participants were then thanked and dismissed.

Materials

Facial primes. Past studies suggest that the ethnicity associated with facial primes should be taken into account (Elfenbein & Ambady, 2002). Previous research has indicated that facial expressions of an ethnicity different from that of the perceiver can elicit incongruent affective reactions (e.g., fearful faces posed by black people can elicit positive, instead of negative emotional responses from Caucasians; Hugenberg, 2005; Weisbuch & Ambady, 2008) or elicit unwanted stereotypic and prejudicial responses (Bargh et al., 1996; Devine, Plant, Amodio, Harmon-Jones, & Vance, 2002; Hugenberg & Bodenhausen, 2003). To avoid these possible confounds, only the faces of Chinese individuals were presented to the participants, who were all of Chinese ethnicity, and the widely used facial expressions constructed by Ekman and Friesen (1976) were not utilized because none of these faces were Chinese. Four Chinese facial expressions (an angry female expression, a sad female expression, an angry male expression, and a sad male expression) were constructed for the present investigation to serve as emotional primes (see Appendix B). Because the effect of gender of the facial primes was not

of interest in this research, the participants were exposed to an equal number of male and female faces.

Agency measure. The 10 negative events used in the agency measure, shown in Appendix C, were derived from interviews with NUS students regarding their everyday experiences and problems in order to reflect common experiences to which undergraduates could relate.

Reported emotion. Participants answered the questions "How angry are you feeling now?" and "How sad are you feeling now?" using a seven-point scale ranging from 1 (*not at all*) *to* 7 (*extremely*).

Pretesting of Awareness

Past studies have indicated that an exposure time of 26 to 28 ms is too brief for most stimuli to be identified (e.g., Stapel et al., 2002)[3]. As the current research examined the effects of subliminally presented stimuli, two pilot studies were conducted to determine the visibility of the facial primes used in the priming procedure.

Pilot Study A. Pilot Study A was designed to investigate whether the participants would be able to recognize the facial expressions in the priming procedure employed in the main experiment of Experiment 1. A sample of 33 participants who did not participate in the main experiment was subjected to the same priming procedure administered in the main experiment. Sixteen participants, of whom eight were exposed to the male face and eight to the female face, were assigned to the Anger Prime condition, and seventeen participants, of whom nine

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[3] Despite this statement, I urge caution in making straightforward comparisons between studies in the visibility of inconspicuous primes. Whether a prime can be identified depends on many factors other than exposure times, such as the type of masks used, the type of primes presented, brightness of the experimental context, and the location of the prime on the computer screen.

were exposed to the male face and eight to the female face, to the Sadness Prime condition. After all 50 trials, the participants were presented with three alternatives (an angry face, a sad face, and a neutral face) of the same gender to which they had been previously exposed and asked to select the expression presented to them. Participants who claimed that they saw no facial expression during the priming procedure were instructed to make a guess. Six of the 16 participants in the Anger Prime condition and 4 of the 17 in the Sadness Prime condition selected the same expression as the face to which they had been previously exposed. As recognition performance across both conditions was not significantly different from chance (33%), $\chi^2 = 0.14$, $p = .71$, it was concluded that the priming procedure was effective in preventing participants from accurately and spontaneously identifying the facial primes. It was also concluded that, consistent with past research, individuals are generally unable to identify facial primes after an exposure time of about 30 ms (Tamir, Robinson, Clore, Martin, & Whitaker, 2004)

Pilot Study B. The finding of Pilot Study A suggested that it would be unlikely that the participants in the main experiment could identify the facial primes. However, this finding only indicated whether individuals could identify the facial primes when did not forewarn of their existence and not explicitly instructed to identify them during the priming procedure. Whether individuals could identify the primes when forewarned about their existence and explicitly instructed to identify them should be examined, because of the possibility that some participants in the main experiment had made an effort to identify the prime. Hence, another sample of 30 participants were subjected to basically the same priming procedure used in the main experiment but with several modifications. These participants were explicitly informed that a picture of a face would be presented briefly during each trial, with

no information regarding gender or emotional expression provided. In each of 24 trials, the participants were exposed to an angry, a sad or a neutral facial prime after the removal of the backward mask (i.e., the "&" mask). After the removal of the facial prime, two faces were presented instead of a Korean word. This substitution was made because the main purpose of Pilot Study B was to test identification accuracy when there was a focused intention to identify the primes. The actual facial prime was presented on one side of the screen and a foil (i.e., a different expression of the same gender) was presented on the other side. The expression, gender, and location of the actual facial prime were balanced and randomized across 24 trials.

The participants were asked to indicate which face they thought had been presented in that trial. Analysis of their responses indicated that their recognition performance was significantly better than chance (50%), $t(29) = 6.04$, $p < .001$ (two-tailed), with the average number of correct identifications being 16.17 out of 24 trials. Hence, if participants were forewarned of the primes and focused on detecting them, they could identify them reasonably well. However, the participants in the main experiment were instructed to focus on Korean words and were not informed of the primes. These two manipulations should successfully minimize the possibility of participants devoting attention and resources to identifying the primes (Li et al., 2008). Therefore, the results of Pilot Study B did not indicate that the effects of the emotional primes on appraisals that Experiment 1 had tested were not subliminal, which can further be supported by the Rosen and Singh (1992) study on subliminal embeds[4]. The subliminal aspect of the primes of Experiment 1 did not arise from the fact that they were presented below the threshold of conscious perception but rather

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[4] "Subliminal embeds are usually clearly visible once pointed out but otherwise remain unnoticed by those who view the presented material" (Rosen & Singh, 1992, p.158).

from the fact that their presence and impact were not spontaneously recognized when they were presented (Rosen & Singh, 1992).

Results

Two trained coders who were blind to the experimental assignment categorized each of the 680 responses provided by the 68 participants into one of the two Agency categories of interest: the Agency-Others or the Agency-Situation category. Specifically, they coded a response indicating that the participant had appraised the event as caused by another person or other individuals as an Agency-Others response and a response indicating that the participant had appraised the event as caused by non-human factors (e.g., the weather) as an Agency-Situation response. For example, for the item "*The night out with your date went badly*", the response "*He was boring*" would be coded as an Agency-Others response whereas the response "*Bad weather*" would be coded as an Agency-Situation response. The inter-rater reliability found to be high ($r = .83$, $p < .001$). All discrepancies were resolved by a third coder also blind to experimental assignment. Respective responses were summed across all 10 event items to provide a composite Agency-Others and an Agency-Situation score. Outliers of more than 2 *SD*s from the means were substituted with the respective average values.

To recapitulate, it was hypothesized that participants in the Anger Prime condition would be more likely to attribute events to other individuals (Agency-Others) and less likely to attribute events to impersonal situational factors (Agency-Situation) than those in the Sadness Prime condition. The results of a 2 (Prime) $\times$ 2 (Agency) mixed ANOVA indicated a non-significant main effect of Prime and a non-significant main effect of Agency, *p*s $> .27$. However, the results indicated a

significant interaction effect between Prime and Agency, $F(1, 66) = 13.07$, $p = .001$, $\eta^2 = .17$. Further analysis indicated that the number of Agency-Others responses ($M = 2.21$, $SD = 1.43$) was significantly higher in the Anger Prime condition than in the Sadness Prime condition ($M = 1.53$, $SD = 0.99$), $t(66) = 2.27$, $p = .01$ (one-tailed), $d = 0.56$, and that the number of Agency-Situation responses was significantly higher in the Sadness Prime condition ($M = 1.97$, $SD = 1.19$) than in the Anger Prime condition ($M = 1.29$, $SD = 0.87$), $t(66) = 2.67$, $p = .005$ (one-tailed), $d = 0.66$. Thus, the results supported the hypothesis. Figure 2.1 shows the effect of Anger Prime versus Sadness Prime on Agency-Others and Agency-Situation responses.
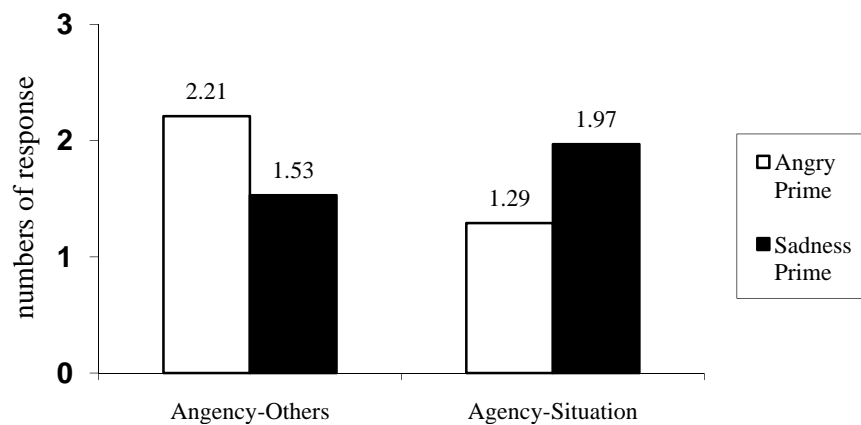
Figure 2.1. Effect of Anger Prime versus Sadness Prime on the number of Agency-Others and Agency-Situation responses in Experiment 1.

On first observation, there appeared to be a number of responses attributing events to the self (Agency-Self). Hence, additional analyses were performed to examine the possible influence of the facial primes on Agency-Self, which is a third major form of agency appraisal. When the extent to which the events were attributed to the self (Agency-Self) was coded (e.g., an answer "*I was in a bad mood*" for the event "*The night out with your date went badly*"), the average number of Agency-Self responses was 4.79 ($SD = 2.01$) in the Anger Prime condition and 4.41 ($SD =$

1.64) in the Sadness Prime condition. Unexpectedly, more internal attributions were elicited than external (human and situation) attributions, all $Fs > 24.23$, $ps < .001$, $\eta^2 > .42$[5]. Further analysis revealed no significant difference in Agency-Self as a function of Prime, $F(1, 66) = 0.74$, $p = .39$, $\eta^2 = .01$.

It can be seen in Figure 2.1 that the numbers of Agency-Others and Agency-Situation responses were relatively low (the average numbers were below 2.3). As each participant only gave one response to each of the 10 events, and all 10 responses were categorized into three kinds of appraisal agency (Agency-Other, Agency-Situation, or Agency-Self)[6], the number of responses of each agency category was not expected to be high. However, the small numbers of responses posed a potential problem in that the reliability of the analysis might be reduced if the distributions of the Agency scores were too skewed to the right. However, the distributions of the Agency scores were actually normal, and even when they were subjected to an appropriate (square-root) transformation and then submitted to the same analysis, the results obtained were just as supportive of the hypothesis as those obtained from the raw scores.

Finally, no effect was found for Prime on reported anger, $t(66) = 0.41$, $p = .68$, or reported sadness, $t(66) = 0.67$, $p = .51$. The reported emotion scores in the Anger Prime condition (reported anger, $M = 2.35$, $SD = 1.25$; reported sadness, $M = 2.62$, $SD = 1.52$) and the Sadness Prime condition (reported anger, $M = 2.24$, $SD = 1.10$; reported sadness, $M = 2.88$, $SD = 1.74$) were low.

Discussion

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[5] Because the present study did not attempt to examine differences between internal and external attributions, this issue is not discussed in the current paper.
[6] Several participants also gave invalid or irrelevant responses that could not be categorized into any of these three appraisal agencies.

Experiment 1 provided initial support for the automatic emotion-specific appraisal effect by supporting the hypothesis that automatically activated emotion-representations should affect the corresponding appraisals in a manner predicted by appraisal theories. Specifically, the results consistently revealed that participants were more likely to appraise negative events as caused by other individuals when they were unconsciously exposed to angry facial primes than when they were exposed to sad facial primes. Conversely, they were more likely to appraise the same events as caused by impersonal situational factors when they were primed with sad faces than with angry faces. Moreover, the anger and sadness prime manipulation only affected appraisals associated with anger (Agency-Others) and sadness (Agency-Situation) but not unrelated appraisals (Agency-Self). The low levels of reported anger and sadness suggested that none of these emotions were strongly felt. Moreover, the reported anger and sadness did not affect by anger and sadness primes.

Other researchers might consider this study's finding that appraisals were affected by subliminally presented facial primes without any corresponding change in emotional experience as a function of the Prime condition as evidence of unconscious emotion (for review, see Berridge & Winkielman, 2003; Wiens & Ohman, 2007). Based on this position, it is possible that unconscious emotions were induced in the current experiment. This speculation makes the low levels of reported anger and sadness understandable, as the method of self-report may not have been sufficiently sensitive or inappropriate for testing unconscious emotions (Nisbett & Wilson, 1977).

Although the results of Experiment 1 appear to support the hypothesis, they should be deemed as tentatively supporting it due to several unresolved issues.

Although Pilot Study A and other past studies using facial primes at exposure time of about 30 ms (e.g., Li et al., 2008; Tamir et al., 2004) found that participants were unable to spontaneously identify the primes if they were not forewarned of their presence, Pilot Study B indicated that the facial primes presented at 26-to-28 ms might be identifiable if participants were told to focus on detecting them. Moreover, no data on whether the primes were recognized by the participants in the main experiment were collected. Thus, it remains unclear how much the subliminal effect of facial primes on appraisal obtained was unconsciously elicited. Hence, to verify that the effect was indeed subliminal, Experiment 2 employed an even shorter exposure timeframe of 16-to-18 ms.

Because only negative events were examined in Experiment 1, it was unclear whether the same effects would occur with agency appraisals of positive events. Keltner et al. (1993; Study I and V) found that consciously experienced anger and sadness influenced agency appraisals of negative events but not of positive events, suggesting that emotions are more likely to influence appraisals of events of congruent valence. Drawing from their findings, it was predicted that subliminally presented angry and sad facial primes would influence Agency-Others and Agency-Situation appraisals of negative events (in the same hypothesized manner) but not of positive events.

CHAPTER 3

EXPERIMENT 2

To address the concerns that arose during Experiment 1, several changes to the experimental design were made in Experiment 2. First, the exposure time of the facial primes was decreased to 16 to 18 ms, with the same Prime $\times$ Agency interaction effect expected even with this extremely short exposure timeframe. To further ensure that the effect was subliminal, data were collected during the debriefing procedure regarding whether the participants in the main experiment had observed the primes. Second, positive events were examined in addition to the negative events examined in Experiment 1. Drawing from Keltner et al. (1993), it was anticipated that the predicted Prime $\times$ Agency interaction effect would occur with the negative events but not with the positive events.

Lastly, all the participants were undergraduate students from Mainland China rather than students from Singapore. This change in participant nationality was made in order to examine the factors behind the unexpectedly small numbers of Agency-Others and Agency-Situation responses in Experiment 1. If the same findings could be replicated within a different cultural context, the evidence for the hypothesized unconscious emotion-specific effects on appraisals of agency would be strengthened. Although both China and Singapore are typically classified as collectivistic cultures, they differ in numerous ways, such as philosophical outlook, cultural values, and personal goals (Lau, 1992), as well as historical development and political culture. There are thus a sufficient number of differences between

China and Singapore to provide an initial but substantive test of the cross-cultural consistency of the results.

Method

Participants

One hundred and twelve students (104 females, mean age = 20.45, $SD =$ 1.22) from the Tangshan Vocational Technical College in China volunteered to participate after appeals for participants were made during their lectures. Half the participants were randomly assigned to the Anger Prime condition and half to the Sadness Prime condition.

Design

Experiment 2 was a mixed-design study that included one between-subject IV (Prime) with two levels (Anger Prime and Sadness Prime), and two within-subject IVs: that of Agency at two levels (Agency-Others and Agency-Situation) and that of Event at two levels (Positive Event and Negative Event). The dependent variable was the number of responses in each agency category.

Procedure and Materials

The procedure and materials used in Experiment 2 differed from those in Experiment 1 in four respects. First, the exposure time of the facial primes was reduced to between 16 ms and 18 ms, as determined by the computer equipment used. This study was conducted using an Acer Aspire notebook computer with a monitor refresh rate of 60 Hz and an ATI Mobility Radeon X1600 video graphic card with 128 MB memory capability. Second, Experiment 2 was conducted in Mandarin, which is the dominant language of the Mainland Chinese participants.

Back-translation was performed to ensure that all instructions and measurement materials were semantically equivalent across the two samples in Experiment 1 and Experiment 2. Third, new positive events based on interviews with undergraduates with regard to everyday events that they commonly encounter were constructed and included. Fourth, two of the negative events from Experiment 1were omitted from Experiment 2 due to the results of a pretest with a different sample of 20 Chinese participants that indicated ceiling effects with these two events. Specifically, 90% of the participants responded to the event item "*Your personal belongings were lost while travelling overseas*" by attributing it to theft, and 75% thought that the event item "*You missed a movie that you wanted to watch*" was impossible. Although these unexpected findings are interesting, suggesting potential cross-cultural differences in how different events are attributed, these items were omitted due to concerns that they might not be appropriate for testing the study hypothesis. In addition, because positive events were included in Experiment 2, the participants in Experiment 2 were required to respond to more events than had the participants in Experiment 1 and thus faced the risk of fatigue effects and the diminishing effects of the facial primes with time. Thus, only eight negative events and eight positive events were examined, as shown in Appendix D.

All other aspects of the procedure and materials remained identical to those in Experiment 1. Hence, in Korean-word rating task, participants assigned to the Anger Prime condition were exposed to angry faces (half of which were male and half female) 50 times, and those assigned to the Sadness Prime condition were exposed to sad faces (half of which were male and half female) 50 times. After completing the Korean-word rating task, the participants completed the agency measure and then the responded to the same self-reported emotion items.

A debriefing conducted at the end of the study revealed that no participants could read Korean, none thought that the tasks were related, and none had knowledge of the research objective. When the participants were asked whether they had seen any faces during the priming task and, if so, what the faces' emotional expression had been (see funnelling debriefing procedure by Bargh & Chartrand, 2000), four of the 56 participants in the Anger Prime condition and nine of the 56 participants in the Sadness Prime condition reported having seen something resembling faces but none could correctly identify their facial expressions.

Pretesting of Awareness

Pilot Study C. As in Experiment 1, two pilot studies were conducted to assess awareness of the facial primes. Pilot Study C was identical to Pilot Study A except that the exposure time of the facial primes was reduced to 16 to 18 ms. Ten participants were exposed to the angry facial primes, of whom five were exposed to the angry male face and five to the angry female face, and 10 participants were exposed to the sad facial primes, of whom five were exposed to the sad male face and five to the sad female face. After all 50 trials, the participants indicated which of three faces (an angry face, a sad face, or a neutral face, all of the same gender as that presented to them during the 50 trials) that they thought had been presented to them. Only three participants in the Anger Prime condition and one in the Sadness Prime condition identified the prime correctly. As recognition performance across both conditions was not higher than chance (33%), the results indicate that primes presented for 16 to 18 ms are extremely difficult to identify correctly if participants are not forewarned of their presence, which is consistent with the finding that none

of the participants in the main experiment of Experiment 2 could correctly identify the facial expressions.

Pilot Study D. As was Pilot Study B in Experiment 1, Pilot Study D was conducted to assess whether the participants could correctly identify the primes if forewarned of their presence and explicitly instructed to identify them, but after an exposure time of only 16 to 18 ms. Twenty-four trials were administered in the same two-alternative, forced-choice recognition task. However, unlike the participants in Pilot Study B, the current participants were unable to identify the primes. Recognition performance was not significantly higher than the chance (50%), $t(19) = 1.05$, $p = .31$(two-tailed), and the average number of correct identifications was 12.60 (out of 24 trials).

In sum, Pilot Studies C and D indicate that the participants were unable to correctly identify facial primes presented for 16 to 18 ms; even if they deliberately focused their attention on the primes, their recognition performance was still not higher than chance level. Moreover, the differences in recognition performance between Pilot Study B and Pilot Study D suggest that changing the prime duration from 26 to 28 ms to 16 to 18 ms significantly reduces the visibility of the facial primes.

Results

Two coders who were blind to the experimental assignment coded the 1,792 responses from all the participants into the same Agency-Others and Agency-Situation categories as the responses in Experiment 1 had been coded. The inter-rater reliability was high ($r = .94$, $p < .001$) and all discrepancies were resolved by a third coder also blind to the experimental assignment. The responses were summed

to produce Agency-Others and Agency-Situation scores, and outliers of more than 2 *SD*s from the means were substituted with the respective average values.

To recapitulate, the hypothesis posited that the differential effects of anger and sadness primes on Agency-Others and Agency-Situation should be found only in the Negative Event condition and not in the Positive Event condition. A 2 (Prime) × 2 (Agency) × 2 (Event) mixed ANOVA revealed a significant main effect of Prime, $F(1, 110) = 9.91$, $p = .002$, $\eta^2 = .08$, a significant main effect of Agency, $F(1, 110) = 7.54$, $p = .007$, $\eta^2 = .06$, and a marginally significant main effect of Event, $F(1, 110) = 7.54$, $p = .06$, $\eta^2 = .06$. More relevant to the hypothesis, the analysis identified a significant two-way interaction between Prime and Agency, $F(1, 110) = 19.63$, $p < .001$, $\eta^2 = .15$, which was qualified by a significant three-way interaction, $F(1, 110) = 4.35$, $p = .04$, $\eta^2 = .04$ (see Figure 3.1). The interaction between Agency and Event was significant, $F(1, 110) = 50.87$, $p < .001$, $\eta^2 = .32$, but the interaction between Prime and Event was not, $F(1, 110) = .12$, $p = .69$, $\eta^2 = .001$. Although all the main effects and interaction effects were interesting, only those that directly related to the hypothesis were further analyzed and discussed.
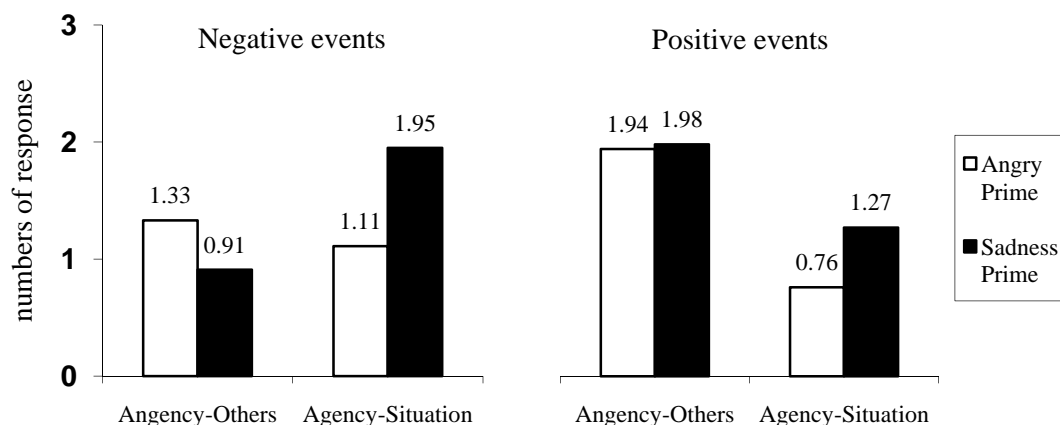

Figure 3.1. Three-way interaction between Prime, Agency, and Event in Experiment 2.

Because the three-way interaction was found to be significant, further analysis was conducted to examine the critical Prime × Agency interaction within each Event condition. Consistent with the predictions, a significant Prime × Agency interaction was found in the Negative Event condition, $F(1, 110) = 41.23$, $p < .001$, $\eta^2 = .27$. Further analysis indicated that in the Negative Event condition, the number of Agency-Others responses was significantly larger in the Anger Prime condition ($M = 1.33$, $SD = 1.08$) than in the Sadness Prime condition ($M = 0.91$, $SD = 0.70$), $t(110) = 2.49$, $p = .007$ (one-tailed), $d = 0.47$, and the number of Agency-Situation responses was larger in the Sadness Prime condition ($M = 1.95$, $SD = 0.71$) than the Anger Prime condition ($M = 1.11$, $SD = 0.64$), $t(110) = 6.56$, $p < .001$ (one-tailed), $d = 1.25$. Hence, the findings of Experiment 1 were replicated using a shorter priming timeframe and a different cultural sample (shown in the left portion of Figure 3.1).

However, no significant Prime × Agency interaction was found in the Positive Event condition, $F(1, 110) = 5.05$, $p = .16$, $\eta^2 = .02$. The pattern of Agency-Others and Agency-Situation responses in the Positive Event condition was not consistent with the hypothesized emotion-specific effects (see the right portion of Figure 3.1). No significant main effect of Prime on Agency-Others was found, $F(1, 66) = 0.04$, $p = .83$, $\eta^2 = .001$, and Agency-Situation, $F(1, 66) = 2.90$, $p = .09$, $\eta^2 = .04$ in the Positive Event condition. Therefore, as predicted, the facial primes affected only appraisals of events of the same valence.

Consistent with Experiment 1, the distributions of the Agency scores were normal, despite the small number of Agency-Others and Agency-Situation responses. Hence, no transformation was needed, and even if the data had been transformed and re-analysed, the results remained similar. The average number of Agency-Self responses generated for the negative events was 4.04 ($SD = 1.56$) in the

Anger Prime condition and 3.71 (SD = 1.37) in the Sadness Prime condition,

whereas the average number of Agency-Self responses generated for the positive

events was 4.43 (SD = 1.04) in the Anger Prime condition and 4.20 (SD = 1.41) in

the Sadness Prime condition. Hence, the Chinese participants in Experiment 2 were

more likely to attribute both negative and positive events to the self than to external

factors (other individuals or impersonal situations) in both prime conditions, all Fs >

56.51, ps < .001, η^2 > .51. A 2 (Prime) × 2 (Event) mixed ANOVA of Agency-Self

responses identified a significant main effect of Event, $F(1, 110)$ = 5.60, p = .02, η^2

= .05, which indicated a greater number of Agency-Self responses in the Positive

Event condition than in the Negative Event condition. As there was no significant

main effect of Prime, $F(1, 110)$ = 2.41, p = .12, η^2 = .02, or significant interaction

effect, $F(1, 110)$ = 0.06, p = .81, η^2 = .001, on Agency-Self, it can be concluded that

the Prime manipulation had no effect on Agency-Self responses across both types of

events.

   As in Experiment 1, reported emotion scores in the Anger Prime condition

(reported anger, M = 2.32, SD = 1.49; reported sadness, M = 2.23, SD = 1.53) and

the Sadness Prime condition (reported anger, M = 1.91, SD = 1.44; reported sadness,

M = 2.00, SD = 1.61) were low (note that the mid-point was 4). The results of a 2

(Prime) × 2 (Reported Emotion) mixed ANOVA indicated no significant interaction

$F (1, 110)$ = 0.44, p = .51. Because neither the main effect of Reported Emotion,

$F(1, 110)$ = 0.00, p = 1.00, nor the main effect of Prime, $F(1, 110)$ = 1.61, p = .21,

was significant, it can be concluded that self-reported anger and sadness did not vary

as a function of Prime.

Discussion

Experiment 2 provided further support to the hypothesis that subliminally presented emotional primes could automatically and systematically affect agency appraisals of events, but only of those events whose valence was consistent with that of the primes. Specifically, when participants were subliminally primed with angry facial primes, they were more likely to appraise negative events as caused by other individuals, whereas when they were subliminally primed with sad facial primes, they were more likely to appraise negative events as caused by impersonal situational factors. In line with previous studies that found that consciously experienced negative emotions could shape causal judgments to negative events but not positive events (Keltner et al., 1993), the anger and sadness primes influenced the appraisals of negative events but not of positive events. Similar valence-specific effects have been found in other subliminal priming studies (Kivikangas & Ravaja, 2009; Ravaja et al., 2004) in which negative primes only influenced the evaluation of negative messages and positive primes only influenced the evaluation of positive messages. The findings of Experiment 2 replicated those of Experiment 1 by indicating that no strong feelings of anger or sadness had been experienced and that the Prime had not affected the self-reported emotion ratings.

One reason why the participants were more inclined to appraise themselves as the causes of positive events than of negative events could be a self-serving bias (Brown & Rogers, 1991; Krusemark, Campbell, & Clementz, 2008), which encouraged them to take responsibility for positive outcomes but not undesired negative outcomes. This tendency may also be one of the reasons why emotional primes only influenced appraisals of negative events: As individuals tend to make

internal attributions to positive outcomes, appraisals of positive events were unlikely

to be influenced by sadness and anger primes.

CHAPTER 4

GENERAL DISCUSSION

volutionary theorists consider emotions to be an adaptive system whose aim is to respond to environmental challenges (for review, see Keltner & Gross, 1999). For such an adaptive system to function optimally, individuals must be capable of reacting automatically to stimuli important to survival, which requires that the emotional system rapidly processes incoming stimuli and be sufficiently sensitive to discriminate among fine differences in stimuli to activate a tailored response to a particular stimulus. An extrapolation of this concept is that the emotional system should have the capacity to extract the subtle differences between an anger-related stimulus and a sadness-related stimulus, even if these stimuli are presented at levels below consciousness, and then automatically activate cognitive functions associated with these emotions. However, no clear evidence of unconscious emotion-specific cognitive effects has been definitively identified, although evidence of conscious emotion-specific cognitive effects and unconscious valence-based cognitive effects has been identified. The current research aimed at filling this research gap by examining the unconscious specific effects of emotional primes on agency appraisals.

Summary of the Findings

Experiment 1 provided preliminary evidence of automatic emotion-specific effects on cognitive processes. Subliminally presenting angry or sad facial primes to the participants influenced their subsequent appraisals of unrelated events in a

manner beyond a simple valence-based evaluation. Specifically, participants briefly primed with angry faces were more likely to attribute negative events to other individuals than those who were primed with sad faces. In contrast, participants briefly primed with sad faces were more likely to attribute the negative events to impersonal situational factors than those primed with angry faces. Notably, these observed effects were not only emotion specific but also appraisal specific. According to appraisal theories (Ellsworth & Smith, 1988; Smith & Ellsworth, 1985), angry and sad facial primes should only facilitate agency appraisals to others and situational factors, respectively, and not to the self (except in the case of self-anger which is strongly associated with Agency-Self; Ellsworth & Tong, 2006). Consistently, the facial primes did not affect the extent to which the participants attributed the events to the self, only the extent to which the same events were attributed to others and situations. Moreover, no participants reported strong conscious feelings of anger or sadness after being exposed to the facial primes, a finding in accord with past studies that also found that subliminally presented primes affected evaluations or behaviours but not emotional feelings (e.g., Ric, 2004; Ruys & Stapel, 2008a; Ruys & Stapel, 2008b; Winkielman et al., 2005; Zemack-Rugar et al., 2007).

Although Pilot Study A verified that the priming procedure was effective in preventing participants from becoming aware of the facial primes when instructed to focus on the Korean words rating and not forewarned of the primes, the findings should be viewed with caution, as the priming still might not have been fully subliminal. When the participants in Pilot Study B had been forewarned of the primes and instructed to detect them, they were able to correctly identify the primes at a level above that of chance. This finding suggests that the observed effects of

emotional primes on appraisals might not be fully unconscious if participants make a deliberate effort at identifying the primes.

By exposing participants from a different culture to the primes for a briefer period to preclude their awareness of the primes, Experiment 2 provided stronger evidence of the hypothesized automatic and unconscious emotion-specific cognitive effects. Pilot Study D verified that the exposure time of the facial primes in Experiment 2 had been too brief to allow for identification, even when the participants had been explicitly forewarned of their presence. Experiment 2 fully replicated the results of Experiment 1, further supporting that emotional stimuli can have a robust emotion-specific effect on appraisals. However, as the two negative emotional primes affected agency appraisals of negative events but not agency appraisals of positive events, the reasons for this valence-specific influence should be further investigated.

<div align="center">Theoretical Importance of the Findings</div>

The current work extends the literature on the impact of affect on cognition and the research into appraisal theories of emotion. First, the majority of studies that have investigated the impact of unconscious emotional priming on cognitive functions identified only valence-based effects but not emotion-specific effects (Chartrand et al., 2006). In particular, many found that attitudinal evaluations tend to be more positive after exposure to subliminally presented positive primes than negative primes, and vice versa. However, studies that identified emotion-specific effects on cognitive functions examined only the effects of consciously experienced emotions and not whether these effects could be elicited by subliminally presented primes (Keltner et al., 1993).

The current research aligns these studies by providing evidence of the existence of unconscious emotion-specific cognitive effects. Specifically, this study found that individuals' attributions to other individuals (Agency-Others appraisals) were facilitated by subliminally primed angry faces and that attributions to impersonal situations (Agency-Situation appraisals) were facilitated by subliminally primed sad faces. It should be noted that the affected cognitive process (the appraisal) in the current research is essentially different from the valence-based evaluations (positive vs. negative) that had been examined as dependent valuables in most previous investigations of the impact of affect on cognition. More cognitive resources are needed for complex causal appraisals than for judgments regarding likability, especially regarding targets that are novel and ambiguous, as the latter could simply be based on "pure feeling" and not require any analytic thinking. The findings of the current study suggest that subliminal emotional priming is capable of influencing complex cognitive processes (such as appraisal) that require elaborative conscious control.

The findings of this research also contribute to appraisal theories research in two additional ways. These findings not only provide further evidence of the impact of emotions on appraisals predicted by appraisal theories (Keltner et al., 1993; Lerner & Keltner, 2000) but also indicate that angry and sad stimuli can automatically impact agency appraisals, even when strong feelings of anger or sadness are absent. In both experiments, the levels of reported anger and sadness activated by subliminally presented facial primes were very low, consistent with data obtained from naturalistic event sampling studies in which participants were at baseline (neutral) emotional states (Tong et al., 2007). Although there was no indication of feelings of strong anger or sadness among the participants, the

participants in both experiments exhibited particular patterns of agency appraisals as a function of the facial primes in a manner predicted by appraisal theories. The fact that emotion-specific information distinct to the facial expressions was unintentionally and unconsciously extracted, producing significant changes in appraisals even in the absence of strong feelings of the corresponding emotions, indicates that significant changes in related appraisals do not require corresponding changes in conscious emotional experiences.

This research used a fairly new method of measuring appraisals. Most studies have measured appraisals by asking participants to rate self-reported appraisal items, such as the item "*How much is this event caused by situational factors?*" (Keltner et al., 1993), a method that has notable advantages as well as limitations. First, any ambiguity in the meaning of the items (e.g., the term *situational factors* could be interpreted in different ways by different participants) would be a source of measurement error. Second, responses to these items may not reflect actual experiences but schematic theories of appraisals and emotions (Parkinson, 1997). Third, a question such as "*How much is this event caused by situational factors?*" lacks ecological validity because individuals typically attribute events to concrete causes rather than general and abstract concepts (e.g., "situational factors"). Fourth, the items may prime inaccurate responses. As shown in this research, the participants attributed few events to other individuals or impersonal situational factors; thus, not every appraisal is appropriate in any given situation (Scherer, 1997). The wording of an appraisal testing item could subtly but incorrectly lead participants to infer that an appraisal had been made when it had truly not been. Moreover, participants may have inferred from the wording of the items that the purpose of the study was to investigate their attribution of agency.

On the other hand, allowing participants to make appraisals in an open-ended format allows them to respond more spontaneously and uninhibitedly, free from contextual influences within the measurement items. This method of assessing appraisals not only allows researchers to assess whether hypothesized appraisals are activated but also explore whether unanticipated appraisals are made, such as the great number of unanticipated Agency-Self appraisals made in this study. Although the method of allowing participants spontaneously stating opinion is comparatively new in appraisal research (Yap & Tong, 2009), it has been widely used in assessing a variety of variables, including stereotypic thoughts (Macrae et al., 1994), request strategies (Forgas, 1999), and deliberative and implemental mind-sets (Gollwitzer, Heckhausen, & Steller, 1990). Taken together, previous research appears to provide considerable evidence in favour of the validity and reliability of this method. However, it should also be noted that this method has limitations, which is that the extent to which an appraisal can be coded from open-ended response depends on the complexity of the appraisal and the nature and length of the responses (Yap & Tong, 2009).

<div align="center">Study Limitations and Future Directions</div>

One limitation of the current research is that participants in both Experiment 1 and Experiment 2 were mostly females. As previous studies have found that females are more facially reactive to facial expressions than males (Dimberg, 1982, 1990), there may be gender difference in this study that future studies should explore.

More research is needed to clarify the mechanism by which subliminally primed facial expressions elicit different appraisal tendencies. It is plausible that this

mechanism may be linked to the human capacity to unintentionally mimic facial expressions. Indeed, research has provided empirical evidence that individuals can unintentionally and spontaneously mimic other individuals' facial expressions (Chartrand & Bargh, 1999; Hatfield, Cacioppo, & Rapson, 1992; Stel, Van Den Heuvel, & Smeets, 2008). Further, subliminally presented facial expressions have been found to induce emotion-congruent physiological and neural reactions (De Gelder, 2005; Phillips et al., 2004). Researchers have also demonstrated that instructing participants to produce facial expressions by manipulating their facial muscles could induce emotional feelings that match the expressions (Duclos et al., 1989; Flack, 2006; Schallhorn & Lunde, 1999). Thus, it is possible that facial primes, even those presented at subliminal levels, could result in spontaneous and unintentional mimicry of the expressions, which in turn could activate emotionally congruent responses, including those pertaining to appraisals. However, empirical investigation is required to provide direct evidence supporting the proposition that the participants in the current research actually mimicked the subliminally presented facial expressions before any conclusion can be made.

This study only examined the specific automatic effects of two negative emotional cues (i.e., angry and sad facial expressions) on agency appraisals. It is important for future studies to investigate the automatic effects of other emotions on other appraisal dimensions. For example, fear is associated with a greater tendency to appraise a situation as uncertain compared to anger (Lerner & Keltner, 2000; Smith & Ellsworth, 1985). Thus, subliminally presented fear-related information may automatically lead individuals to perceive more risk in subsequent situations than subliminally presented anger-related information. In addition, the appraisal dimension of Control is known to differ between gratitude and pride (Ortony et al.,

1988; Smith & Ellsworth, 1985). Hence, subliminally presented gratitude-related stimuli may result in appraisals of lower control than subliminally presented pride-related stimuli.

Future research could also extend the present research by examining how subliminally presented cues affect other components of the emotion system, besides cognitive processes in a parallel manner. Recent studies have consistently demonstrated that behaviours such as drinking and helping are affected by not only subliminally presented valence-based primes (Winkielman et al., 2005) but also subliminally presented emotion-specific primes. For example, Zemack-Rugar et al. (2007) found that individuals subliminally primed with guilt-related words subsequently demonstrated more helping behaviours than those who were subliminally primed with sadness-related words. It remains unclear whether and how subliminally presented emotion-specific stimuli affect action tendencies, autonomic responses, and communicative responses, as well as how strongly various components are organized as a function of such emotional primes.

Conclusion

The findings of this study provide support to the proposition that subliminally presented emotional primes can activate emotion-specific cognitive responses, and thus demonstrate the sensitivity of the human emotional system. Specifically, the results indicate that the human emotional system can differentiate and process information associated with specific emotions at unconscious levels. The cognitive consequences of such subliminal effects are not restricted to simple valence-based evaluations but also more complex appraisals. Further, these reactions can occur outside of conscious awareness and without the experience of strong

subjective emotional feelings, as they only require that corresponding emotion representations be activated, even unconsciously. The present research enriches the literature regarding appraisal theories of emotion and provides possible directions for future investigations that could further develop these theories to gain better understanding of the human emotional system.

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APPENDICES

Appendix A: Korean words used in the priming procedure in Experiment 1 and 2

Korean words	meanings	Korean words	meanings
의자	(chair)	공기	(air)
시계	(watch)	섬유	(fiber)
베개	(pillow)	토지	(land)
마루	(floor)	문제	(question)
모자	(hat)	테마	(theme)
보틀	(bottle)	안경	(glasses)
도어	(door)	전화	(telephone)
왼쪽	(left)	텐트	(tent)
커튼	(curtain)	숫자	(number)
램프	(lamp)	원인	(cause)
거울	(mirror)	결과	(result)
모래	(sand)	머신	(machine)
타올	(towel)	건물	(building)
칫솔	(toothbrush)	키친	(kitchen)
박스	(box)	봉투	(envelope)
신문	(newspaper)	언어	(language)
연필	(pencil)	평면	(plane)
트럭	(truck)	지도	(map)
로프	(rope)	재료	(material)
시간	(time)	날씨	(weather)
공간	(space)	장소	(place)
셔츠	(shirt)	지붕	(roof)
비누	(soap)	소리	(voice)
네트	(net)	화상	(picture)
시장	(market)	보행	(walk)

Appendix B: Facial primes used in Experiment 1 and 2

Appendix C: Events used in Experiment 1

Your personal belongings were lost while travelling overseas.

You did not do as well in a graded assignment as you expected.

The night out with your date went badly.

Your team members met each other for the first time, but you could not contribute to the conversation.

You bought a product you did not really need.

You had a quarrel with a loved one (family member/friend).

You lost contact with your friend.

You missed a movie that you wanted to watch.

You did not get along with your team mate.

Your contribution to your work went unrecognized.

Appendix D: Events used in Experiment 2

You did not do as well in a graded assignment as you expected.

The night out with your date went badly.

Your team members met each other for the first time, but you could not contribute to the conversation.

You bought a product you did not really need.

You had a quarrel with a loved one (family member/friend).

You lost contact with your friend.

You did not get along with your team mate.

Your contribution to your work went unrecognized.

You had extra allowances for the month.

You found a book you always wanted.

A very bad habit of yours was kicked.

You received a treat from your friend.

You did a project that was highly praised.

You were nominated as the leader of a group project.

A cold war with your good friend finally ended.

You met a friend and he/she complimented on your appearance.