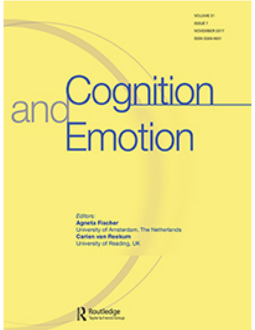

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Toward an implicit measure of emotions: ratings of abstract images reveal distinct emotional states

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ABSTRACT

Although implicit tests of positive and negative affect exist, implicit measures of distinct emotional states are scarce. Three experiments examined whether a novel implicit emotion-assessment task, the rating of emotion expressed in abstract images, would reveal distinct emotional states. In Experiment 1, participants exposed to a sadness-inducing story inferred more sadness, and less happiness, in abstract images. In Experiment 2, an anger-provoking interaction increased anger ratings. In Experiment 3, compared to neutral images, spider images increased fear ratings in spider-fearful participants but not in controls. In each experiment, the implicit task indicated elevated levels of the target emotion and did not indicate elevated levels of non-target negative emotions; the task thus differentiated among emotional states of the same valence. Correlations also supported the convergent and discriminant validity of the implicit task. Supporting the possibility that heuristic processes underlie the ratings, group differences were stronger among those who responded relatively quickly.

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Emotion; emotion induction; misattribution; implicit assessment

A major recent advance in psychological science is the development of implicit measures of psychological traits and states (e.g. De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Nosek, Hawkins, & Frazier, 2011). Implicit measures are employed extensively thanks to their capacity to overcome limitations associated with explicit self-reports (Uhlmann et al., 2012). Despite this trend, at least one significant area of study lacks well-developed implicit measures: distinct emotions (Mauss & Robinson, 2009) – phenomenological states that are differentiable from one another on dimensions beyond mere valence and arousal (Russell, 2003).

This absence of well-developed implicit measures is particularly significant in that self-reports of emotion have long been known to possess significant drawbacks (e.g. Kagan, 1989). Demand characteristics and social desirability concerns may prompt individuals to enhance positive and deny negative aspects of their experiences when self-reporting (Paulhus & Reid, 1991). Explicit requests for reports of one's emotional state may activate analytic and reflective processes (e.g. Quirin, Kazén, & Kuhl, 2009) that alter emotional experience (Keltner, Locke, & Audrain, 1993). Moreover, when reporting emotions, people rely not only on experiences of online emotions but also on cold cognitive processes (e.g. situation-specific beliefs; Robinson & Clore, 2002). Some people, such as those with repressive coping style or alexithymia, are particularly unable to identify and report emotions accurately (Lane, Ahern, Schwartz, & Kaszniak, 1997; Weinberger, Kelner, & McClelland, 1997). McLaughlin et al. (2016) find that, in a fear conditioning paradigm, maltreated children display relatively high levels of physiological fear arousal yet do not differ from others in fear self-reports. Such limitations may lower the validity of emotion self-reports (Abercrombie, Kalin, & Davidson, 2005; Langens, 2002; Quirin, Kazén, Rohrmann, & Kuhl, 2009) and contribute to unusual findings in the literature. For example, Polivy (1981) observed that after manipulations designed to induce a single emotional state (e.g. an anger-provoking accusation, a fear-inducing threat of an electric shock),

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participants reported elevation of multiple emotional states (e.g. anger, anxiety and depression). Such results, combined with curiously large co-occurrences among self-reports of distinct emotional states, led Polivy (1981) to suggest that "our scales may be at fault" (p. 811), with participants exhibiting "introspective laziness" when self-reporting and thus being relatively "unable to distinguish what they feel beyond positive and negative" (p. 816; also see Mauss & Robinson, 2009).

Although self-report methods have been, and surely will remain, one critical component of emotion assessment, these findings highlight the need to expand the range of tools with which distinct emotional experiences can be assessed. An implicit measure of distinct emotional states would facilitate a multimethod measurement and complement the existing self-report measures of emotion. The study of emotion would benefit from an implicit task possessing three qualities: the abilities to (a) accurately capture variability of emotional experience, (b) differentiate among emotions of the same valence and (c) do so quickly and efficiently.

We present a method that capitalises on the finding that affective states influence evaluative judgements (e.g. Abercrombie et al., 2005; Schwarz & Clore, 1983). When evaluating stimuli, people's current affective experiences may serve as an information source even if these stimuli did not affect such experiences (Schwarz, 2011). Heuristic, emotion-based processes (e.g. Forgas, 2001) contribute to these effects and allow mood to be examined indirectly (Langens, 2002). For example, in Quirin, Kazén, and Kuhl (2009) Implicit Positive and Negative Affect Test, participants rate the degree to which each of six non-words (e.g. TUNBA) convey positive (e.g. happy) and negative (e.g. helpless) feelings. These ratings reveal participants' state and trait affect.

Distinct emotional states (e.g. anger, fear, sadness) also exert unique effects on judgement (Lench, Flores, & Bench, 2011), and this phenomenon has been used to implicitly assess emotions. For example, Krieglmeyer, Wittstadt, and Strack (2009) presented subliminal non-word letter strings followed by four response options: three neutral and one anger-related (e.g. hate, fury, anger). Participants guessed which word had appeared previously based on their gut feelings. Those who had been evaluated negatively by a confederate selected more anger-related response options than did participants who had received a positive evaluation.

Blaison, Imhoff, Hühnel, Hess, and Banse (2012) used a variation of the Affect Misattribution Procedure (AMP; Payne, Cheng, Govorun, & Stewart, 2005) to examine the possibility of an implicit assessment of both anger and fear. On this modified AMP, participants saw, in a brief succession, a picture of a face with an angry, fearful or neutral expression followed by a Chinese ideograph, which they categorised as evoking fear or anger. Presentations of affective stimuli (i.e. facial expressions) influenced ratings of the subsequent Chinese ideographs.[1]

Drawing upon heuristic processes and previous assessment methods (e.g. Blaison et al., 2012; Krieglmeyer et al., 2009), the goal of this study was to test whether a novel implicit emotion-assessment task, the rating of emotion expressed in abstract images, would reveal distinct emotional states.

Overview

In an initial step towards an implicit assessment of distinct emotions, we investigated the utility of a novel task, in which participants rate emotional states that artists expressed in abstract expressionist images. The task incorporates four strategies of assessment. First, as in previous implicit assessment methods (e.g. Blaison et al., 2012; Krieglmeyer et al., 2009; Quirin, Kazén, Rohrmann, et al., 2009), participants evaluate non-self-targets (i.e. abstract paintings) rather than describing their own feelings. Non-self-ratings can reduce biases that may occur when people explicitly describe themselves (Paulhus & Reid, 1991).

Second, unlike some prior work (cf. Blaison et al., 2012; Krieglmeyer et al., 2009; Quirin, Kazén, Rohrmann, et al., 2009), we avoided any self-referential questions by instructing participants to quickly indicate what emotion an artist tried to express in each abstract painting. People are less likely to (over) correct effects of their emotions on judgment when asked questions with ostensibly objective (versus subjective) answers (cf. Murphy & Zajonc, 1993, Studies 1 and 2).

Third, we employed a forced-choice scale (cf. Blaison et al., 2012; Krieglmeyer et al., 2009) selecting one emotion option (rather than providing precise ratings of each emotion on Likert scales). Compared to prior work, we extended the number of emotion terms to four: anger, fear, sadness and happiness. Of note is that the instructions and response scale were designed to prompt heuristic processing, which is more common when people are not motivated to be accurate and can respond to prompts with little effort (Forgas, 2001).

Fourth, we presented pictorial stimuli because pictures may be more intrinsically related to emotional experience than words (Glaser & Glaser, 1989). Moreover, the exceptional ambiguity of abstract expressionist images makes it plausible that any given image could be expressive of various emotional qualities.

The three experiments reported here include experimental emotion inductions designed to test whether participant ratings of the artists' visual expressions would vary as a function of distinct emotional states, rather than as a function of the non-distinct valence of induced affect.

Experiment 1

Experiment 1 featured emotion inductions designed to induce either sadness or a relaxed state. After the inductions, participants inferred the emotional content of: (a) abstract paintings, and for comparison purposes, (b) neutral faces. They also completed an explicit self-report measure of emotional states.

Method

Participants

Introductory Psychology students ($N = 109$;[2] 77 women) participated in exchange for a partial course credit. Participants, run individually, were randomly assigned to either a sadness ($n = 53$) or a relaxation ($n = 56$) induction condition. Three participants (2.8%) were excluded from the analyses: One lacked English proficiency, another guessed the research hypothesis early in the session, and a third learned the hypothesis from a prior participant.

Procedures

Emotion induction

After a consent procedure, a cover story indicated that the research concerned how visual information interferes with auditory information, and that different participants would see different visual information. Sadness or relaxation was then induced through guided visualisation. Participants imagined themselves in a situation that was described via an audio-recording lasting approximately five and a half minutes and presented through headphones (cf. Cervone, Kopp, Schaumann, & Scott, 1994). The recording began by encouraging participants to relax and clear their minds of extraneous thoughts.

The sadness story described a best friend who was dying of cancer; participants were instructed to think about a friend of an opposite sex. The relaxation story described walking through a forest towards a beach and enjoying the beach and ocean; the sound of waves played in the background.[3]

Materials and measures

Participants next completed our novel implicit emotion-assessment task. Participants viewed and rated 20 abstract expressionist artworks, some colourful and others black-and-white, presented one-at-a-time on a computer screen. They were asked to indicate what emotion the artist had tried to express in the given image, and to rely on their first impression of the image when making the rating. Each painting remained on screen until the participant chose, using a computer mouse, one of five response options: anger, fear, sadness, happiness or none (i.e. no emotion).

For comparison purposes, we presented eight black-and-white frontal pose face pictures (four male and four female; selected from http://pics.psych.stir.ac.uk). Because emotions influence ratings of facial expressions particularly when expressions are neutral (Langens, 2002) or presented briefly (e.g. Winton, Clark, & Edelmann, 1995), we presented faces with neutral expressions for 67 milliseconds. Participants judged what emotion, if any, the face expressed by choosing one of the five response options (anger/fear/sadness/happiness/none). Painting and face stimuli were presented in separate blocks, with block order counterbalanced and stimuli ordered randomly within each block.

As an explicit measure of emotions, we used a modified version of the Profile of Mood States (POMS; McNair, Lorr, & Droppleman, 1971). Participants indicated on 5-point Likert scales (1 = *Not at all* to 5 = *Extremely*) the extent to which each of 31 randomly presented affective adjectives described emotions they experienced while listening to the story (asterisks indicate items that do not appear on the POMS): *sadness* (*sad/discouraged/blue/hopeless/unhappy/miserable/helpless*), *happiness* (*relaxed/energetic/cheerful/carefree/lively/happy*/peaceful*/delighted*/content*/optimistic**), *anger* (*angry/spiteful/annoyed/resentful/bitter/rebellious/furious*) and *fear* (*fearful*/panicky/anxious/shaky/terrified/uneasy/on* *edge*). Participants completed this measure subsequent to the implicit task to reduce the possibility of suspicion about the research hypotheses. Participants were then debriefed.

Results

Figure 1(a) displays participants' ratings of the emotion expressed in abstract paintings. Results supported our main hypothesis. Compared to the relaxation-induction group, sadness-induction participants rated more paintings as expressing sadness and fewer as expressing happiness, and did not rate more paintings as expressing anger or fear. A mixed ANOVA found a significant Condition-by-Painting Rating interaction, $F(3, 102) = 4.21$, $p = .008$, $\eta_p^2 = .11$. Compared to the relaxation-induction, sadness-induction increased inferences of sadness, $F(1, 104) = 5.95$, $p = .016$, $d = 0.47$, and lowered inferences of happiness, $F(1, 104) = 9.45$, $p = .003$, $d = 0.60$, in the paintings. Moreover, as expected, the groups did not differ in inferences of anger or fear ($ps > .36$). This finding provides initial evidence that ratings of abstract stimuli correspond to the raters' distinct emotional states.

Figure 1(b) displays results from the face-rating task, for which a mixed ANOVA indicated that the Condition-by-Face Rating interaction was not significant, $F(3, 102) = 1.96$, $p = .13$, $\eta_p^2 = .05$. Follow-up analyses (which should be interpreted cautiously in light of the non-significant ANOVA result) indicated that, compared to the relaxation group, the sadness group saw more faces as expressing sadness, $F(1, 104) = 3.97$, $p = .049$, $d = 0.38$. The groups did not differ in ratings of faces on other emotions ($ps > .17$). Ratings of faces thus partly mirrored ratings of paintings, with similar results in attributions of sadness, fear and anger, but unexpected results in attributions of happiness.

Table 1 displays mean levels of self-reported emotions. Participants exposed to the sadness induction reported higher levels of sadness than any other emotion, and higher levels of sadness than participants in the relaxation condition. A mixed ANOVA found a significant Condition-by-Explicit Emotion interaction, $F(3, 102) = 190.90$, $p < .001$, $\eta_p^2 = .85$. Compared to the relaxation group, the sadness group reported being less happy, $F(1, 104) = 388.73$, $p < .001$, $d = 3.86$, more sad, $F(1, 104) = 299.89$, $p < .001$, $d = 3.29$, more fearful, $F(1, 104) = 142.32$, $p < .001$, $d = 2.27$ and more angry, $F(1, 104) = 108.61$, $p < .001$, $d = 1.97$. In light of the fact that the groups differed in all explicit emotions, we also examined self-reports within each condition. Planned contrasts indicated that the sadness group reported being more sad than angry, $F(1, 49) = 57.34$, $p < .001$, fearful, $F(1, 49) = 35.22$, $p < .001$ or happy, $F(1, 49) = 139.99$, $p < .001$. Conversely, the relaxation group reported higher levels of happiness than sadness, $F(1, 55) = 747.16$, $p < .001$, which did not differ significantly from levels of anger or fear ($ps > .18$).

Secondary analyses: response times on the implicit emotion-assessment task

Not all participants rated stimuli quickly, per instructions; median response times varied from 1.91 to 22.24 seconds ($M = 5.62$, $SD = 3.30$). If emotional states influence ratings in our task primarily through quick, heuristic processes (cf. Greifeneder, Bless, & Pham, 2011), then the group differences should be more pronounced among participants who responded to the painting stimuli relatively quickly.

We therefore analysed implicit emotion ratings among slow and fast responders, defined as participants above and below the median in response times[4] (Figure 1(c)). *Post hoc* mixed ANOVAs revealed that, among slow respondents, the Condition-by-Painting Rating interaction was not significant, $F(3, 49) = 4.21$, $p = .258$, $\eta_p^2 = .08$. However, among fast respondents, the interaction was just below the significance threshold, $F(3, 49) = 2.78$, $p = .051$, $\eta_p^2 = .15$, with group differences in attribution of both sadness, $F(1, 51) = 5.17$, $p = .027$, $d = 0.62$, and happiness, $F(1, 51) = 5.69$, $p = .021$, $d = 0.65$.

Discussion

The results provide initial evidence that ratings of emotion expressed in abstract art may be indicative of people's distinct emotional states. Participants exposed to a sadness induction inferred sadness in art images more frequently, and happiness less frequently, than participants in a relaxation condition. On this implicit task, sadness-induction participants did not display higher levels of the non-target negative emotions, anger and fear.

Explicit self-reports of emotion also indicated that participants in the sadness-induction condition experienced higher levels of sadness. However, on the explicit measure, these participants also reported higher

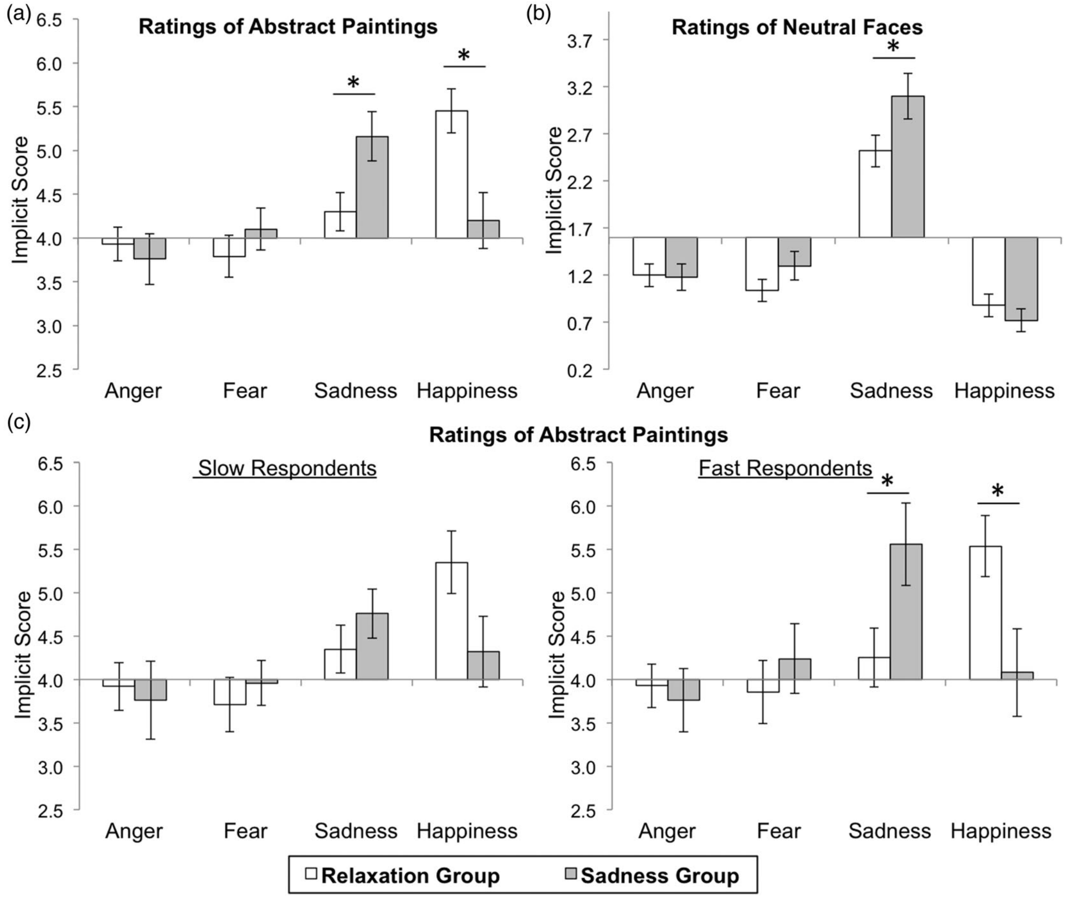

Figure 1. Attribution of emotions to (a) abstract paintings and (b) neutral faces as a function of the emotion-induction condition. (c) Attributions of emotions to abstract paintings for slow (left) and fast (right) respondents as a function of the emotion-induction condition.

Notes: Error bars represent standard errors of the means. By chance alone, each response would be attributed on average to 4 paintings (20 paintings/5 responses) or 1.6 faces (8 faces/5 responses); thus, the horizontal axes crosses the vertical axes at the corresponding points. *p < .05

levels of the non-target negative emotions (cf. Polivy, 1981).

A secondary data analysis revealed that group differences on the implicit emotion-assessment task were larger among participants who responded to test items relatively quickly. This finding is consistent with the possibility that rapid heuristic processes contributed to the influence of emotion states on ratings of abstract art images.

Emotion attributions were more evident in ratings of unfamiliar and novel objects: abstract paintings, rather than common everyday stimuli: neutral faces. As indexed by the effect sizes, the group differences were expectedly larger when attributing sadness and happiness to abstract paintings than to faces. Moreover, on the face-rating task, both sad and relaxed participants inferred sadness at levels above chance and happiness at levels below chance. In other words, participants in both conditions perceived the neutral faces to look inherently sad. Participants interpreted the valance of these pictures despite the brief, 67-millisecond presentations of the face stimuli. This may be because, unlike recognition of other objects, recognition of faces is a domain-specific and holistic process (McKone, Kanwisher, & Duchaine, 2007) allowing people to distinguish backward-masked happy expressions from angry and fearful ones even if presented for merely 20 milliseconds (Sweeny, Suzuki, Grabowecky, & Paller, 2013). Such ability to quickly extract information from face stimuli may diminish the need to rely on one's emotions as information in judgement.

In conclusion, the first experiment revealed that when experiencing sadness, people are more likely

Table 1. Means (and standard deviations) of self-reported emotions in Studies 1–3.

	Self-reports			
Condition/group	Anger	Fear	Sadness	Happiness
Experiment 1				
Relaxation	**1.13** (0.18)	**1.23** (0.39)	**1.18** (0.63)	**3.68** (0.25)
Sadness	**2.45** (0.92)	**2.90** (0.96)	**3.46** (0.53)	**1.44** (0.95)
Experiment 2				
Control	1.38 (0.50)	1.54 (0.68)	1.66 (0.78)	**1.78** (0.75)
Anger	1.54 (0.76)	1.43 (0.49)	1.45 (0.58)	**1.53** (0.63)
Experiment 3				
Neutral image				
Controls	**1.31** (0.69)	**1.23** (0.57)	**1.59** (0.88)	**2.43** (1.12)
Spider-fearful	**2.39** (1.23)	**2.38** (1.22)	**2.76** (1.14)	**3.33** (1.00)
Spider image				
Controls	**1.56** (0.83)	**1.53** (0.90)	**1.68** (0.82)	2.55 (1.13)
Spider-fearful	**2.56** (0.78)	**2.84** (1.16)	**2.33** (0.88)	2.72 (1.27)

Note: Means in bold indicate significant group differences at $p < .05$.

to misattribute it to abstract paintings than to facial expressions. These misattributions are much greater among fast (versus slow) respondents. This finding should prove crucial in future efforts to develop an implicit emotion measure.

Experiment 2

In Experiment 2, we determined whether our implicit assessment would be sensitive to the effects of an induced emotion other than that of Experiment 1. To provide contrast with sadness: a low-arousal emotion characterised by withdrawal in the face of loss, we exposed people to a social encounter likely to induce anger: a high arousal emotion associated with motivation to act against a source of harm (Smith & Lazarus, 1990).

Method

Participants

Introductory psychology students ($N = 162$) participated in exchange for a partial course credit. Participants were randomly assigned to an anger or a control condition. Eleven anger-condition participants withdrew from the experiment; thus complete data were collected from 151 participants (97 women), with 75 and 76 in the anger and control conditions, respectively. Nine anger-condition participants who guessed that the experiment involved an anger manipulation were not included in analyses, leaving a final pool of 142 participants with mean age of 19.2 years (SD = 2.28).

Emotion induction

In both experimental conditions, participants were informed that the study concerned the relation between general intelligence and emotional intelligence, and that they would complete tests of both intelligence types (cf. Lobbestael, Arntz, & Wiers, 2008). In both conditions, the experimenter delivered information in a calm, perfunctory manner; the conditions thus differed in the information presented, but not in the experimenter's interpersonal demeanour.

The anger condition adapted a previously developed method (Kenworthy, Canales, Weaver, & Miller, 2003). The experimenter informed participants that their experimental session would take about 15 minutes (the session actually lasted 45 minutes). The experimenter left the lab room after participants began the first computer-based test: math test, in which they needed to solve one problem in order to move to the next. After several minutes, the experimenter re-entered purportedly to check on the participant. At this point, the anger induction began. The experimenter looked at the computer screen, expressed surprise, and declared that he must have had started the wrong program. While starting the next test, a set of 12 anagrams, the experimenter muttered that "the last 20 minutes were just a waste of time".

The next test consisted of 12 anagrams. The experimenter explained that the participant would need to provide anagram solutions via a microphone and wear headphones throughout the task. Each anagram appeared on the screen for up to 30 seconds (or until any key press) followed by a high pitch tone and a request, displayed for 4 seconds, to state the answer aloud. Participants were to say, "I don't know" if they had no solution. Subsequently, a message displaying the correct answer appeared for 4 seconds, followed by the next anagram.

After the 4th, 9th and 12th anagrams, the headphones emitted a loud, irritating noise accompanied by the on-screen message, "The system cannot detect your answer: please speak LOUDER." (This prompted some participants to scream answers into the microphone.) After the final anagram, a white-font "critical program failure" message on a blue background indicated that the program had crashed. The experimenter pretended to address the crash by pressing keyboard keys and blamed the participant for the program failure. He then nonchalantly announced that because no data likely had been saved, the participant could not receive the participation credit. (The 11 participants who requested withdrawal at this point were immediately debriefed and received full credit.) Before leaving the room again, the experimenter instructed participants to complete the last test, the implicit emotion-assessment task, and not to "mess up anything again".

In the control condition, participants were informed that the experimental session would take 45 minutes. They were presented with the math items and then the anagrams. After the math test, the experimenter simply announced that time was up, thanked participants and started the anagram test. No error messages, irritating sounds or program failure messages occurred during that test. The implicit task followed the anagram test.

Materials and measures

The implicit emotion-assessment task was identical to that of Experiment 1, with participants inferring the emotion expressed in each of the 20 abstract paintings. As an explicit emotion measure, we employed four subscales of the Positive and Negative Affect Schedule-Expanded Form (PANAS-X): Hostility/Anger, Fear, Sadness and Joviality/Happiness. The PANAS-X correlates highly with the POMS, but its discriminant validity may be superior to that of the POMS (Watson & Clark, 1994). Participants indicated on 5-point scales (1 = *Not at all*; 5 = *Extremely*) the extent to which each of 25 randomly presented emotion adjectives described their current feelings.

After the emotion induction and emotion assessments, participants provided demographic information and responded to questions about their beliefs regarding the research hypotheses.

Results

Our implicit task was sensitive to the distinctive effects of the anger induction (Figure 2(a)). A mixed analysis of covariance[5] (ANCOVA) found the Condition-by-Implicit Emotion interaction to be significant, $F(3, 137) = 2.75$, $p = .045$, $\eta_p^2 = .06$. As predicted, people in the anger condition attributed anger to more paintings than did the control-condition participants, $F(1, 139) = 4.04$, $p = .046$, $d = 0.32$, and the groups did not differ in inferences of fear or happiness ($ps > .24$). The anger group displayed marginally lower levels of sadness than did the control group ($p = .065$).

Table 1 displays levels of self-reported emotions. A mixed ANCOVA revealed a significant Condition-by-Explicit Emotion interaction, $F(3, 137) = 3.53$, $p = .017$, $\eta_p^2 = .07$. Individuals in the anger condition reported being less happy than did those in the control condition, $F(1, 139) = 4.21$, $p = .042$, $d = 0.36$. However, the group difference in self-reported anger had a small effect size and was non-significant, $F(1, 139) = 2.39$, $p = .13$, $d = 0.25$. There was a trend for the anger group to report lower levels of sadness compared to the control group ($p = .088$), and the two groups did not differ in reports of fear ($p > .31$).

Secondary analyses: response times on the implicit emotion-assessment task

As in Experiment 1, the emotion attributions of slow and fast respondents were analysed separately (Figure 2(b)). Among slow respondents, the Condition-by-Implicit Emotion interaction was not significant, $F(3, 66) = 1.05$, $p = .38$, $\eta_p^2 = .05$, but fell just short of significance among fast respondents, $F(3, 66) = 2.70$, $p = .053$, $\eta_p^2 = .11$. Among fast respondents, participants in the anger group attributed anger to more paintings than did those in the control group, $F(1, 68) = 4.34$, $p = .041$, $d = 0.38$. No other differences in implicit emotions[6] were significant for fast respondents ($ps > .29$ for implicit fear and happiness; although anger group tended to rate fewer paintings as expressing sadness than the control group did, $p = .091$).

Discussion

Experiment 2 documents that our implicit emotion assessment is sensitive to the effects of an anger

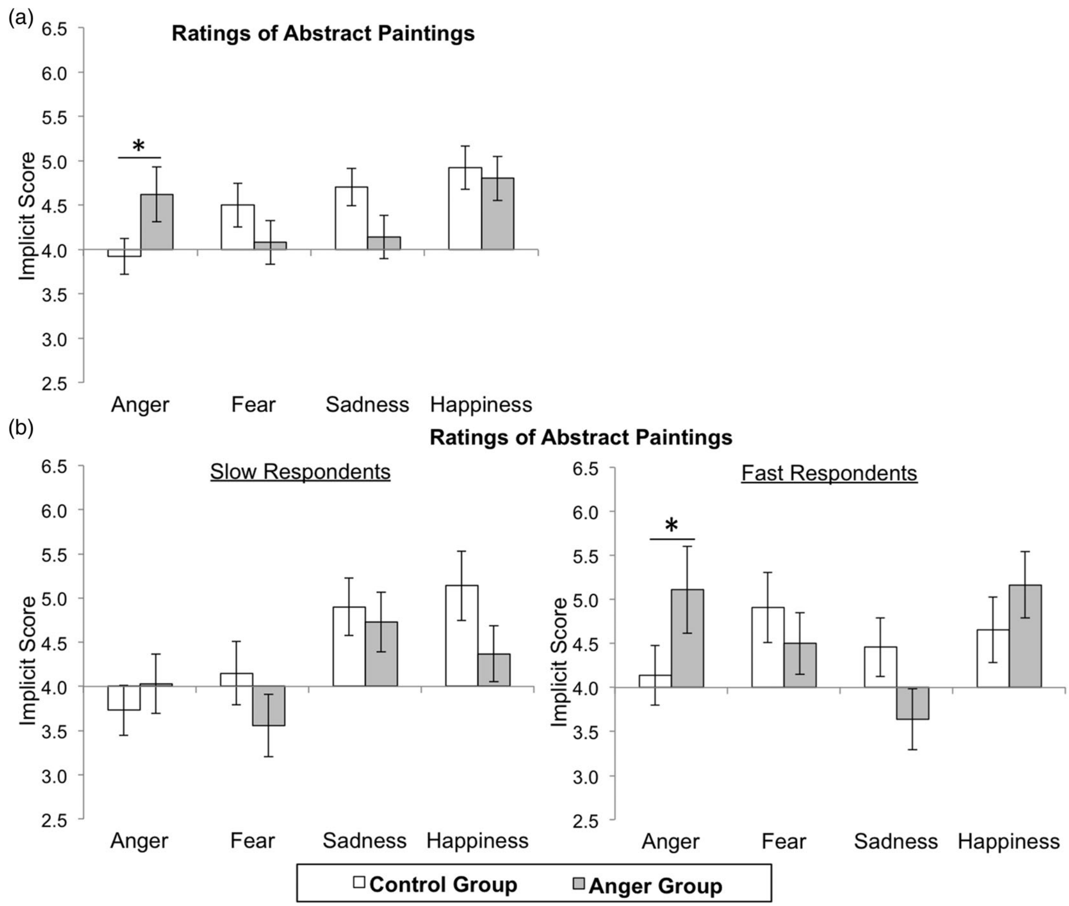

Figure 2. (a) Attribution of emotions to abstract paintings as a function of the emotion-induction condition. (b) Attributions of emotions to abstract paintings for slow (left) and fast (right) respondents as a function of the emotion-induction condition.

Notes: Error bars represent standard errors of the means. By chance alone, each response of the implicit emotion-assessment task would be attributed on average to four paintings; thus the horizontal axes crosses the vertical axes at 4. *p < .05

induction. On the implicit task, participants in the control and anger conditions differed in anger but not in other emotions. The group difference in misattributions of anger was pronounced among participants who responded to the implicit items relatively quickly.

On the self-report measure, participants in the anger condition reported less happiness but not more anger, as compared to control-condition participants. The self-report measure did not detect elevations in anger even though the anger manipulation appeared to be particularly strong, as eleven out of 86 (12.8%) participants withdrew from the anger condition stating that they felt upset about being treated unfairly. Moreover, some of those who continued participating conveyed frustration on the open-ended questions about the true purpose of the research.[7] One possibility is that the information (in the anger condition) that participants would not receive credit may have reduced participants' motivation to self-reflect and report carefully on the self-report measure. A non-reflective style may, by comparison, be advantageous to implicit painting-ratings, which rely on reflexive (heuristic) processing.

Experiment 3

Experiment 3 tested the ability of our implicit emotion-assessment task to detect variations in fear. We manipulated fear by assigning participants high and low in fear of spiders to conditions in which they viewed either spider or neutral images.

Method

Participants

Participants, recruited via Amazon's Mechanical Turk (MTurk) website, included 93 low-spider-fear controls (Fear of Spiders Questionnaire (FSQ) ≤ 10; $M = 3.41$, SD = 3.45) and 90 spider-fearful individuals (FSQ $\geq$ 70; $M = 91.14$, SD = 13.93). Participants were from 15 countries (51% residing in the U.S.), with 101 women and 80 men between 18 and 69 years old ($M = 34.8$, SD = 11.48). Two participants did not provide demographic information. Data from four participants (2.2%) were excluded from the analyses: One provided the same response option for all test items, and three indicated that images did not display properly.

Materials and measures

Twenty pictures of spiders were used to induce fear. Seven portrayed a spider on a person's hand, arm, shoulder or face; the remaining depicted spiders only. Twenty neutral pictures[8] were taken from the International Affective Picture System with the valence ratings ($M = 4.98$, SD = 0.24) between 4.63 and 5.56 (Lang, Bradley, & Cuthbert, 2008). All images were 640 × 480 pixels.

Implicit and explicit emotion measures were identical to those of Experiment 2. For the PANAS-X, participants were asked to indicate emotions they experienced while viewing the images. We measured spider fear with 18-item FSQ, which has good internal consistency (alpha = .92) and good convergent validity, and differentiates well between spider phobics and non-phobics (Szymanski & O'Donohue, 1995).

Procedure

The experiment was programmed in Qualtrics (Provo, UT) and posted via the MTurk website, with a restriction to only those who had at least an 80% approval rate for their previous tasks. We used the FSQ as a screening tool and paid \$0.05 for its completion. Eligible participants (with FSQ scores ≤10 or ≥70; cf. Bartoszek & Winer, 2015) were automatically offered participation in the main part of the experiment for an additional \$0.50.

Participants were randomly assigned to a spider-image ($n = 91$) or a neutral-image ($n = 92$) condition. Because the emotional effects of still images may be ephemeral, pictorial stimuli were presented immediately prior to each abstract painting. Depending on the condition, participants viewed images of either spiders or neutral content, with each image presented for one second. Participants were asked to ignore the images and to provide ratings solely on the content of the paintings.

Upon providing implicit painting-ratings, participants were asked whether images were presented properly. Those in the spider-image condition also indicated on a 5-point scale (1 = *Not at all* to 5 = *Extremely*) how frightening the pictures of spiders were. Next, all participants completed the PANAS-X, provided demographic information, and were debriefed.

Results

The implicit task again revealed variation in the distinct emotional state targeted by our manipulation. As presented in Figure 3, compared to all other groups, spider-fearful participants viewing spider images displayed higher attributions of fear but similar attributions of anger or sadness. A mixed Group × Image Type × Implicit Emotion ANOVA revealed that the Image Type-by-Implicit Emotion interaction was not significant, $F(3, 173) = 1.49$, $p = .22$, $\eta_p^2 = .03$, but the Group-by-Implicit Emotion interaction was, $F(3, 173) = 2.86$, $p = .038$, $\eta_p^2 = .05$. Compared to controls, spider-fearful participants rated more paintings as expressing fear, $F(1, 175) = 5.38$, $p = .021$, $d = 0.34$ (Figure 3). The two groups did not differ in attribution of anger or sadness ($ps > .13$), but the spider-fearful individuals tended to attribute happiness to more paintings than did the controls ($p = .073$).

More important, the three-way interaction was significant, $F(3, 173) = 2.74$, $p = .045$. The follow-up analyses indicated a significant Group-by-Image Type interaction for attributions of fear, $F(1, 175) = 9.92$, $p = .002$, but non-significant interactions for attributions of other emotions ($ps > .63$). As predicted, in the spider-image condition, spider-fearful participants rated more paintings as expressing fear, $t(88) = 3.55$, $p < .001$, $d = 0.75$, than did the controls. However, in the neutral-image condition, the two groups did not differ in fear ratings, $t(87) = 0.65$, $p = .52$, $d = 0.14$.

Table 1 displays mean levels of self-reported emotions. Spider-fearful individuals exposed to spider images reported higher levels of fear than did control participants exposed to spider images (although the group differences were not limited to self-reported fear). A mixed Group × Image Type × Explicit Emotion ANOVA revealed significant Group-

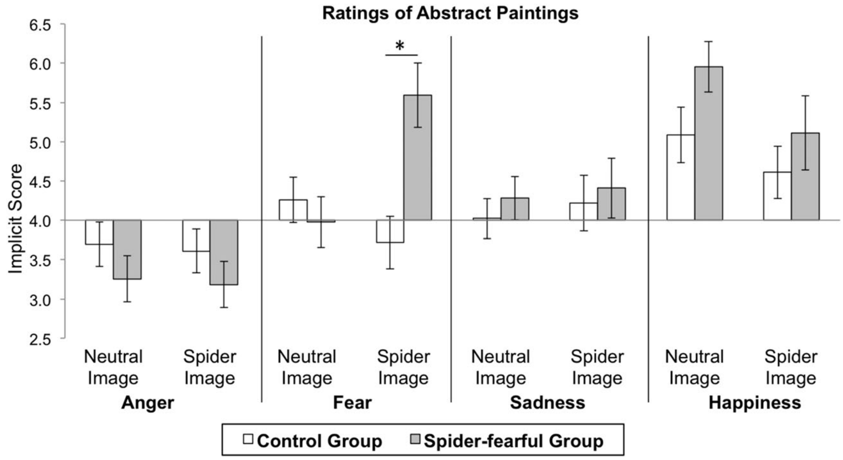

Figure 3. Attribution of emotions to abstract paintings as a function of the group and the image type.

Notes: Error bars represent standard errors of the means. By chance alone, each response of the implicit emotion-assessment task would be attributed on average to four paintings; thus the horizontal axis crosses the vertical axis at 4. $^*p < .05$

by-Explicit Emotion, $F(3, 173) = 3.20$, $p = .025$, $\eta_p^2 = .05$, and Image Type-by-Explicit Emotion, $F(3, 173) = 6.86$, $p < .001$, $\eta_p^2 = .11$, interactions. Specifically, participants who saw spider images reported higher levels of fear than those who saw neutral images, $F(1, 175) = 6.63$, $p = .011$, $d = 0.33$. However, the two groups did not differ in self-reported anger, sadness or happiness ($ps > .15$). Moreover, the three-way interaction fell just short of significance, $F(3, 173) = 2.63$, $p = .052$, $\eta_p^2 = .04$. Follow-up analyses showed that the Group-by-Image Type interaction was significant for self-reported happiness only, $F(1, 175) = 4.63$, $p = .033$. Spider-fearful participants viewing spider images reported being less happy than spider-fearful participants viewing neutral images, $t(85) = 2.49$, $p = .015$, $d = 0.53$, but the type of image did not affect happiness reported by controls, $t(90) = 0.51$, $p = .61$, $d = 0.11$.

That the Group-by-Image Type interaction did not reach significance for negative emotions suggests that, compared to controls, the two spider-fearful groups reported higher levels of anger, fear and sadness regardless of the image type (i.e. neutral or spider) they saw. We further explored this pattern and found that spider-fearful participants viewing spider images did tend to report higher levels of fear, $t(85) = 1.83$, $p = .070$, $d = 0.39$, but lower levels of sadness, $t(85) = 1.96$, $p = .054$, $d = 0.42$, than did the spider-fearful participants viewing neutral images. Moreover, the two spider-fearful groups did not differ on anger ($p = .44$).

Table 2. Correlations of implicit emotions with self-reported indices of spider phobia – Experiment 3.

Implicit emotion	FSQ score	Threat rating
Anger	−.08	−.05
Fear	**.32****	**.41*****
Sadness	.00	.04
Happiness	.13	−.10

Note: FSQ, fear of spiders questionnaire. Significant correlations are bolded.
$^{**}p < .01$.
$^{***}p < .001$.

Construct validity

The convergent and discriminant validity of the implicit emotion-assessment task was examined through correlations of the ratings with two indices of spider phobia: (a) FSQ scores and (b) ratings of spider pictures in terms of threat. As expected and evident in Table 2, we found that the implicit task displayed convergent and discriminant validity in that the implicit fear, but not anger or sadness, correlated positively with the two indices of spider phobia.[9]

Discussion

Our implicit emotion-assessment task revealed the pattern of emotional responses expected from analyses of spider phobia and phobics' responses to threatening images (cf. Schienle, Schäfer, Walter, Start, & Vaitl, 2005). Spider-fearful individuals displayed higher levels of implicitly measured fear, but not higher anger or sadness, after viewing spider images. Correlational data also provided evidence for convergent and discriminant validity of the implicit task. Participants' implicit fear scores uniquely correlated with indices of their spider fears: the FSQ scores and ratings of spider images in terms of threat.

When rating their emotional states explicitly, spider-fearful individuals reported elevated fear, sadness and anger as compared to control participants, and did so regardless of the image type that they viewed. Self-reports thus did not reveal the distinctive pattern of fear response that would be expected on theoretical grounds, that would be consistent with brain-imaging results obtained with spider phobics (Schienle et al., 2005), and that were revealed by implicit painting-ratings.

Meta-analysis of Experiments 1–3

Each experiment reported here compared an experimental condition targeting a distinct emotion to a control condition. To further assess the implicit task's ability to differentiate among emotions of the same valence, we combined data across experiments. It included four groups: sadness (Experiment 1), anger (Experiment 2), fear (Experiment 3; spider-fearful participants exposed to spider images) and control (the control conditions of Experiments 1 and 2, and Experiment 3's non-fearful participants exposed to neutral images;[10] $n = 178$).

Each experimental group evidenced higher attributions of the target emotions (but not other emotions) compared to the combined control group or to the other experimental groups. A mixed ANOVA revealed a significant Group-by-Implicit Emotion interaction, $F(9, 1002) = 4.68$, $p < .001$, $\eta_p^2 = .04$. Groups differed significantly in implicitly measured: sadness, $F(3, 334) = 2.82$, $p = .039$, $\eta_p^2 = .03$, anger, $F(3, 334) = 5.08$, $p = .002$, $\eta_p^2 = .04$ and fear, $F(3, 334) = 6.15$, $p < .001$, $\eta_p^2 = .05$. Planned contrasts revealed that, compared to the control group: (a) the anger group attributed more anger, $t(242) = 2.68$, $p = .008$, $d = 0.35$; (b) the fear group attributed more fear, $t(220) = 3.95$, $p < .001$, $d = 0.58$, and less anger, $t(220) = 2.08$, $p = .039$, $d = 0.38$ and (c) the sadness group attributed more sadness, $t(226) = 2.44$, $p = .015$, $d = 0.41$, and less happiness, $t(226) = 2.53$, $p = .012$, $d = 0.42$, to the abstract paintings. The experimental groups did not differ from the control group on any other emotions ($ps > .32$).

Comparisons using least significant difference *post hoc* tests showed that the anger group rated more images as expressing anger than did the fear group, $t(108) = 3.78$, $p < .001$, $d = 0.64$ or the sadness group, $t(114) = 2.35$, $p = .019$, $d = 0.38$. The fear group had higher implicit fear scores compared to the anger group, $t(108) = 3.76$, $p < .001$, $d = 0.63$ and the sadness group, $t(92) = 3.48$, $p = .001$, $d = 0.66$. The sadness group rated more images as expressing sadness than did the anger group, $t(114) = 2.80$, $p = .005$, $d = 0.52$ or (marginally so) the fear group, $t(92) = 1.88$, $p = .063$, $d = 0.33$. No other group differences reached significance ($ps > .15$).

We also examined the construct validity of the implicit task in relation to the explicit emotion measures. Because explicit and implicit measures may tap into unique aspects (e.g. analytic versus heuristic processes) of the same phenomenon, these measures often correlate weakly or do not correlate at all with each other (e.g. Hofmann, Gawronski, Gschwendner, Huy, & Schmitt, 2005; Roefs et al., 2011).

Because the explicit emotions measures varied across experiments, we standardised self-report scores. Correlations between explicitly and implicitly measured emotions (Table 3, top) support the convergent validity in that (a) each implicit emotion correlated positively with the corresponding explicit emotion, (b) implicit anger and sadness correlated negatively with explicit happiness and (c) implicit happiness correlated negatively with explicit negative emotions (although marginally so with explicit sadness). We also found support for the discriminant validity in that of the six remaining correlations, five were non-significant.

Across the 16 correlations, the direction of only one was unexpected: Self-reported anger correlated

Table 3. Correlations (top) and partial correlations (bottom) between explicit and implicit emotions.

	Implicit emotion			
Explicit emotion	Anger	Fear	Sadness	Happiness
Anger	**.11***	**.15****	.04	−.18**
Fear	.02	**.22*****	.09	−.12*
Sadness	−.03	.09†	**.13***	−.09†
Happiness	−.16**	.00	−.11*	**.26*****
Anger	**.12***	.06	−.08	−.09
Fear	.00	**.19****	.02	−.04
Sadness	−.10†	−.08	**.11***	.04
Happiness	−.14*	.03	−.11†	**.23*****

Note: Convergent correlations are underlined. Significant positive correlations are bolded.
†$p < .10$.
*$p \leq .05$.
**$p < .01$.
***$p < .001$.

positively with implicit fear. This might have resulted from participants over-reporting emotions of the same valence (e.g. reporting anger when experiencing fear; cf. Polivy, 1981). Hence we re-examined correlations of implicit emotions with each explicit emotion while controlling for all other explicit emotions. Among these partial correlations (Table 3, bottom), self-reported anger was no longer significantly correlated with implicit fear, and the overall pattern of correlations remained mainly the same. In summary, the meta-analysis of our three experiments provides support for the sensitivity, specificity and the construct validity of the implicit emotion-assessment task.

General discussion

The results of three experiments suggest that a task in which participants rate the emotion expressed in abstract paintings holds value as an implicit measure of distinct emotional states. In each experiment, participants completed this task subsequent to a manipulation designed to induce a specific negative emotion (sadness, anger or fear). In each experiment, ratings revealed an elevated level of the target emotion and no elevation of non-target negative emotions. The implicit task thus successfully differentiated among distinct emotional states of the same valence.

These emotion-specific results on the implicit task are especially noteworthy in that, as in prior research (e.g. Polivy, 1981; Watson & Clark, 1994), explicit self-reports did not distinguish among similarly valenced emotions. One explanation for the task differences is that explicit assessment relies on controlled, deliberate, reflective processes whereas implicit assessment taps into automatic, heuristic, reflexive processes (Nosek et al., 2011). This differential manner of assessment results in at least two classes of findings: (a) implicit measures sometimes predict emotion-laden phenomena when explicit measures fail to do so and (b) correlations between the two types of measures are often low or non-significant. For example, implicit methods of mood assessment predicted naturally occurring (Quirin, Kazén, Rohrmann, et al., 2009) and experimentally manipulated (Abercrombie et al., 2005) changes in cortisol levels, whereas self-report measures were unrelated to such changes and did not differentiate between experimental conditions. Additionally, subliminally presented positive (versus negative or neutral) stimuli affected: (1) responses on an indirect measure of mood (Weinberger et al., 1997), (2) judgement ratings of subsequent neutral stimuli and (3) behavioural responses (Winkielman & Berridge, 2004), yet these effects were not indexed by self-report measures. Similarly, responses to an implicit affect measure predicted fears of failure among participants who imagined a goal pursuit; however, self-reported mood did not capture any significant changes and was uncorrelated with the implicit measure (Langens, 2002). This lack of or low convergence between different emotion measures is common and indicative that each measure explains a unique variance of emotional experience (Mauss & Robinson, 2009).

Our interpretation of the results is that the experimental procedures induced specific emotional states that were reflected accurately in participants' ratings on the implicit emotion-assessment task. An alternative possibility, suggested by self-reports, is that the procedures elevated multiple emotions to roughly equal degrees. This alternative, however, is inconsistent with much emotion theory and research. For example, in appraisal theories of emotions, anger and sadness are distinguished on the appraisal dimension of agency (Smith & Lazarus, 1990) and thus would not be expected to co-occur. Consistent with these expectations, inductions of sadness or anger blunt the subsequent emotions of anger or sadness, respectively (Winterich, Han, & Lerner, 2010).

Moreover, our induction procedures highlighted relational themes and cognitive appraisals known to be linked to specific emotional states (Smith & Lazarus, 1990). Experiment 1 highlighted the theme of loss and contained no mention of other-blame or impending harm, and thus would be expected to produce sadness and not anger or fear. Experiment 2 procedures featured motivational incongruence, other-blame and unfairness, and thus would be expected to generate anger, not fear or sadness. Regarding Experiment 3, brain-imaging research documents that spider phobics viewing spider images experience greater activation in the amygdala, a neural system underlying fear response (Schienle et al., 2005).

Correlational data also supported the validity of our task as an emotion-assessment tool. Specifically, we found support for convergent and discriminant validity in that participants' fear attributions, but not attributions of other emotions, predicted their fear of spiders and threat ratings of the spider pictures. Similarly, each implicit emotion correlated with corresponding self-reported emotion but not other explicit emotions (especially when controlling for the remaining explicit emotions).

Our task is implicit in that participants' reliance on their own emotional experiences when rating the abstract paintings appears to be automatic (De Houwer et al., 2009). Because participants were not directly asked about their emotional reactions in any of the experiments and were unaware that Experiment 2 involved an anger manipulation, the misattributions seemed unintentional. Moreover, the process of misattribution seemed uncontrollable, as it was evident despite Experiment 3's instructions to disregard the emotion-inducing stimuli when rating abstract images. Finally, misattributions were fast and efficient in that they were present among fast (but not slow) respondents.

It is noteworthy that group differences in emotion misattributions were much larger among fast than slow respondents, with the latter group showing virtually no effects of the emotion-induction procedures. These response-time findings are consistent with the hypothesis that a rapid feeling heuristic may be responsible for the impact of the emotion inductions on ratings (cf. Greifeneder et al., 2011) although other processes could be involved (De Houwer et al., 2009) and future research should further explore this. These response-time results provide essential information, as a modification of the implicit emotion-assessment procedure with imposed response time limits should yield an effective and quick to complete implicit measure of distinct emotional states that could complement the existing self-report measures of emotion and allow for a multimethod assessment.

When employing emotion inductions, there is a possibility that (a) non-emotional artefacts of the emotion-induction procedures or (b) demand characteristics are responsible for obtained results. Relying on the same emotion-induction procedure across studies may be problematic because findings may be due to physical and/or mental demands of the procedure rather than emotions themselves (e.g. Stemmler, Heldmann, Pauls, & Scherer, 2001). To circumvent this problem, we utilised emotion-induction procedures that differed markedly across our experiments.

It is also unlikely that demand characteristics are responsible for the success of the implicit task, for a number of reasons. First, in Experiments 1 and 2, the experimenters provided participants with fictitious rationales. Participants' speculations about the research hypothesis were generally inaccurate, and those who realised the purpose of emotion inductions were excluded from analyses and thus their responses could not affect the results. Moreover, if participants in Experiment 2 were responding according to demand characteristics, they would have endorsed elevated levels of anger not only on the implicit task but also on the self-report measure; yet this was not the case. Additionally, in Experiment 3, participants were explicitly asked to ignore the real-life images and to rate only the paintings. Furthermore, all the experiments relied on between-subject designs, which further obscure hypotheses from participants. The response-time findings also argue against a demand-characteristics interpretation of the results. Fast responders would have had less time to contemplate any potential experimental demands, yet they evidenced stronger effects of the manipulation.

Future research should more systematically explore different features of the implicit emotion-assessment task to further optimise its psychometric properties. For example, a manipulation of time available for making responses would allow for examination of the effects of such manipulations on the magnitude of emotion misattributions. It would also be helpful to more directly examine the mechanisms underlying the effects presented here and the extent to which lower level affective dimensions (e.g. valence, arousal, approach-motivation) contribute to these effects. Future studies could also examine the effects of emotion misattribution when using non-pictorial stimuli (e.g. the artificial words; cf. Quirin, Kazén, & Kuhl, 2009) or non-forced-choice scales.

Notes

1. Research on the AMP findings is mixed in that some investigators (i.e. Blaison et al., 2012) conclude that only cold semantic priming underlies the AMP effects whereas others (Gawronski & Ye, 2014) argue that both semantic concepts and affective feelings drive the misattributions.
2. In order to detect at least a medium effect size ($f = .25$), power analyses determined a sample size for each experiment based on an alpha error set to 0.05 and a recommended statistical power of .8.
3. The scripts and audio-recordings of the stories are available from the first author upon request.
4. A median split procedure is sometimes associated with a loss of power, as it adopts the assumption that variances within each group (i.e. high and low) of the dichotomised variable is meaningless. While this assumption is often unwarranted, we believe that, in this case, the assumption is justified. That is, we do not expect that among slow

respondents, there is a difference between a person who takes 8 seconds to rate an image and the person who takes 12 seconds. Both of these individuals would rely on more deliberate, controlled process than someone who takes 3 or 4 seconds to make such ratings. In other words, the person making the ratings uses either slow, controlled processes or fast, heuristic processes. Indeed, studies show that there are behavioural and neural differences between those responding fast or slowly to auditory or visual stimuli (e.g. Protzner & McIntosh, 2007), and thus median splits of reaction times are often preferred (e.g. Protzner & McIntosh, 2007; Smith, Johnstone, & Barry, 2006). Finally, we used the full range of our data rather than removing data of participants near the median to create more distinct groups.

5. The duration time of the math test (which was part of the anger-induction procedure) varied across participants and was used as a covariate in all analyses of between-condition differences.
6. By "implicit emotion" or "explicit emotion," we are referring to (emotion) assessment procedures that are implicit or explicit. We are not proposing ontologically distinct realms of emotion, implicit versus explicit.
7. For example, in response to the question, "What do you think was the actual purpose of this study?" one participant in the anger condition wrote, "The real purpose was to give me a faulty file so I could waste an hour of my life and not receive credit for taking time out of my schedule to help some dude get a degree."
8. Neutral pictures included: 7000, 7002, 7004, 7006, 7009, 7010, 7025, 7035, 7090, 7100, 7140, 7150, 7175, 7186, 7205, 7217, 7233, 7235, 7705 and 7950.
9. Participants' response times were not measured in this online experiment, and thus we could not perform separate analyses for slow and fast respondents.
10. We collapsed data across the three control groups, as they neither interacted with nor differed in any of the implicitly measured emotions (*ps* > .10).

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References

Abercrombie, H. C., Kalin, N. H., & Davidson, R. J. (2005). Acute cortisol elevations cause heightened arousal ratings of objectively nonarousing stimuli. *Emotion (Washington, D.C.)*, *5*(3), 354–359. doi:10.1037/1528-3542.5.3.354

Bartoszek, G., & Winer, E. S. (2015). Spider-fearful individuals hesitantly approach threat, whereas depressed individuals do not persistently approach reward. *Journal of Behavior Therapy and Experimental Psychiatry*, *46*, 1–7. doi:10.1016/j.jbtep.2014.07.012

Blaison, C., Imhoff, R., Hühnel, I., Hess, U., & Banse, R. (2012). The Affect Misattribution Procedure: Hot or not? *Emotion*, *12*(2), 403–412. doi.org/10.1037/a0026907

Cervone, D., Kopp, D. A., Schaumann, L., & Scott, W. D. (1994). Mood, self-efficacy, and performance standards: Lower moods induce higher standards for performance. *Journal of Personality and Social Psychology*, *67*(3), 499–512. doi:10.1037//0022-3514.67.3.499

De Houwer, J., Teige-Mocigemba, S., Spruyt, A., & Moors, A. (2009). Implicit measures: A normative analysis and review. *Psychological Bulletin*, *135*(3), 347–368. doi:10.1037/a0014211

Forgas, J. P. (2001). The Affect Infusion Model (AIM): An integrative theory of mood effects on cognition and judgments. In L. L. Martin & G. L. Clore (Eds.), *Theories of mood and cognition* (pp. 99–134). Mahwah, NJ: Erlbaum.

Gawronski, B., & Ye, Y. (2014). What drives priming effects in the affect misattribution procedure? *Personality and Social Psychology Bulletin*, *40*(1), 3–15. doi:10.1177/0146167213502548

Glaser, W. R., & Glaser, M. O. (1989). Context effects in Stroop-like word and picture processing. *Journal of Experimental Psychology: General*, *118*(1), 13–42.

Greifeneder, R., Bless, H., & Pham, M. T. (2011). When do people rely on affective and cognitive feelings in judgment? A review. *Personality and Social Psychology Review*, *15*(2), 107–141. doi:10.1177/1088868310367640

Hofmann, W., Gawronski, B., Gschwendner, T., Huy, L., & Schmitt, M. (2005). A meta-analysis on the correlation between the implicit association test and explicit self-report measures. *Personality and Social Psychology Bulletin*, *31*(10), 1369–1385. doi:10.1177/0146167205275613

Kagan, J. (1989). *Unstable ideas: Temperament, cognition, and self*. Cambridge, MA: Harvard University Press.

Keltner, D., Locke, K. D., & Aurain, P. C. (1993). The influence of attributions on the relevance of negative feelings to personal satisfaction. *Personality and Social Psychology Bulletin*, *19*(1), 21–29.

Kenworthy, J., Canales, C., Weaver, K., & Miller, N. (2003). Negative incidental affect and mood congruency in crossed categorization. *Journal of Experimental Social Psychology*, *39*(3), 195–219. doi:10.1016/S0022-1031(03)00022-2

Krieglmeyer, R., Wittstadt, D., & Strack, F. (2009). How attribution influences aggression: Answers to an old question by using an implicit measure of anger. *Journal of Experimental Social Psychology*, *45*(2), 379–385. doi:10.1016/j.jesp.2008.10.003

Lane, R. D., Ahern, G. L., Schwartz, G. E., & Kaszniak, A. W. (1997). Is alexithymia the emotional equivalent of blindsight? *Biological Psychiatry*, *42*(9), 834–844.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). *International Affective Picture System (IAPS): Affective ratings of pictures and instruction manual* (Technical Report A-8). Gainesville: University of Florida.

Langens, T. A. (2002). Tantalizing fantasies: Positive imagery induces negative mood in individuals high in fear of failure. *Imagination, Cognition, and Personality*, *21*(4), 281–292.

Lench, H. C., Flores, S. A., & Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: A meta-analysis of experimental emotion elicitations. *Psychological Bulletin*, *137*(5), 834–855. doi:10.1037/a0024244

Lobbestael, J., Arntz, A., & Wiers, R. W. (2008). How to push someone's buttons: A comparison of four anger-induction methods. *Cognition & Emotion*, *22*(2), 353–373. doi:10.1080/02699930701438285

Mauss, I. B., & Robinson, M. D. (2009). Measures of emotion: A review. *Cognition & Emotion*, *23*(2), 209–237. doi:10.1080/02699930802204677

McKone, E., Kanwisher, N., & Duchaine, B. C. (2007). Can generic expertise explain special processing for faces? *Trends in Cognitive Sciences*, *11*(1), 8–15. doi:10.1016/j.tics.2006.11.002

McLaughlin, K. A., Sheridan, M. A., Gold, A. L., Duys, A., Lambert, H. K., Peverill, M., … Pine, D. S. (2016). Maltreatment exposure, brain structure, and fear conditioning in children and adolescents. *Neuropsychopharmacology*, *41*(8), 1956–1964. doi:10.1038/npp.2015.365

McNair, D. M., Lorr, M., & Droppleman, L. F. (1971). *Profile of Mood States*. San Diego, CA: Educational and Industrial Testing Service.

Murphy, S. T., & Zajonc, R. B. (1993). Affect, cognition, and awareness: Affective priming with optimal and suboptimal stimulus exposures. *Journal of Personality and Social Psychology*, *64*(5), 723–739.

Nosek, B. A., Hawkins, C. B., & Frazier, R. S. (2011). Implicit social cognition: From measures to mechanisms. *Trends in Cognitive Sciences*, *15*(4), 152–159. doi:10.1016/j.tics.2011.01.005

Paulhus, D. L., & Reid, D. B. (1991). Enhancement and denial in socially desirable responding. *Journal of Personality and Social Psychology*, *60*(2), 307–317.

Payne, B. K., Cheng, C. M., Govorun, O., & Stewart, B. D. (2005). An inkblot for attitudes: Affect misattribution as implicit measurement. *Journal of Personality and Social Psychology*, *89*(3), 277–293. doi:10.1037/0022-3514.89.3.277

Polivy, J. (1981). On the induction of emotion in the laboratory: Discrete moods or multiple affect states? *Journal of Personality and Social Psychology*, *41*(4), 803–817.

Protzner, A. B., & McIntosh, A. R. (2007). The interplay of stimulus modality and response latency in neural network organization for simple working memory tasks. *Journal of Neuroscience*, *27*(12), 3187–3197. doi:10.1523/JNEUROSCI.4963-06.2007

Quirin, M., Kazén, M., & Kuhl, J. (2009). When nonsense sounds happy or helpless: The Implicit Positive and Negative Affect Test (IPANAT). *Journal of Personality and Social Psychology*, *97*(3), 500–516. doi:10.1037/a0016063

Quirin, M., Kazén, M., Rohrmann, S., & Kuhl, J. (2009). Implicit but not explicit affectivity predicts circadian and reactive cortisol: Using the implicit positive and negative affect test. *Journal of Personality*, *77*(2), 401–425. doi:10.1111/j.1467-6494.2008.00552.x

Robinson, M. D., & Clore, G. L. (2002). Belief and feeling: Evidence for an accessibility model of emotional self-report. *Psychological Bulletin*, *128*(6), 934–960. doi:10.1037//0033-2909.128.6.934

Roefs, A., Huijding, J., Smulders, F. T. Y., MacLeod, C. M., de Jong, P. J., Wiers, R. W., & Jansen, A. T. M. (2011). Implicit measures of association in psychopathology research. *Psychological Bulletin*, *137*(1), 149–193. doi:10.1037/a0021729

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, *110*(1), 145–172. doi:10.1037/0033-295X.110.1.145

Schienle, A., Schäfer, A., Walter, B., Stark, R., & Vaitl, D. (2005). Brain activation of spider phobics towards disorder-relevant, generally disgust- and fear-inducing pictures. *Neuroscience Letters*, *388*(1), 1–6. doi:10.1016/j.neulet.2005.06.025

Schwarz, N. (2011). Feelings-as-information theory. In P. Van Lange, A. Kruglanski, & E. T. Higgins (Eds.), *Handbook of theories of social psychology: Volume one* (pp. 289–308). Thousand Oaks, CA: Sage Press.

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*, 513–523.

Smith, J. L., Johnstone, S. J., & Barry, R. J. (2006). Effects of pre-stimulus processing on subsequent events in a warned Go/NoGo paradigm: Response preparation, execution and inhibition. *International Journal of Psychophysiology*, *61*(2), 121–133. doi:10.1016/j.ijpsycho.2005.07.013

Smith, C. A., & Lazarus, R. S. (1990). Emotion and adaptation. In L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 609–637). New York, NY: Guilford Press.

Stemmler, G., Heldmann, M., Pauls, C. A., & Scherer, T. (2001). Constraints for emotion specificity in fear and anger: The context counts. *Psychophysiology*, *38*(2), 275–291.

Sweeny, T. D., Suzuki, S., Grabowecky, M., & Paller, K. A. (2013). Detecting and categorizing fleeting emotions in faces. *Emotion*, *13*(1), 76–91. doi:10.1037/a0029193

Szymanski, J., & O'Donohue, W. (1995). Fear of Spiders Questionnaire. *Journal of Behavior Therapy and Experimental Psychiatry*, *26*(l), 31–34.

Uhlmann, E. L., Leavitt, K., Menges, J. I., Koopman, J., Howe, M., & Johnson, R. E. (2012). Getting explicit about the implicit: A taxonomy of implicit measures and guide for their use in organizational research. *Organizational Research Methods*, *15*(4), 553–601. doi:10.1177/1094428112442750

Watson, D., & Clark, L. A. (1994). *The PANAS-X: Manual for the Positive and Negative Affect Schedule–Expanded Form*. Iowa City: University of Iowa.

Weinberger, J., Kelner, S., & McClelland, D. C. (1997). The effects of subliminal symbiotic stimulation on free-response and self-report mood. *Journal of Nervous and Mental Disease*, *185*, 599–605.

Winkielman, P., & C. Berridge, K. (2004). Unconscious emotion. *Current Directions in Psychological Science*, *13*(3), 120–123. doi:10.1111/j.0963-7214.2004.00288.x

Winterich, K. P., Han, S., & Lerner, J. S. (2010). Now that I'm sad, it's hard to be mad: The role of cognitive appraisals in emotional blunting. *Personality & Social Psychology Bulletin*, *36*(11), 1467–1483. doi:10.1177/0146167210384710

Winton, E. C., Clark, D. M., & Edelmann, R. J. (1995). Social anxiety, fear of negative evaluation and the detection of negative emotion in others. *Behaviour Research and Therapy*, *33*(2), 193–196. doi:10.1016/0005-7967(94)E0019-F