Avoidant attachment and hemispheric lateralisation of the processing of attachment- and emotion-related words

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Studies of adult attachment indicate that intimacy avoidance is associated with general negative emotionality and withdrawal from potentially positive aspects of social relations. Such emotional negativity and withdrawal motivation have been connected in psychophysiological studies with the right frontal lobe of the brain, whereas the left frontal lobe specialises in emotional positivity and approach behaviour. In the present study we used a divided visual field task to investigate hemispheric asymmetries in making decisions about the positivity or negativity of attachment- and emotion-related words, as well as various kinds of control words. We found that more avoidant individuals made more errors when judging positive attachment-related words presented to the right hemisphere. The findings are discussed in terms of possible effects of attachment history on the way attachment-related information is processed in the brain.

One of the leading frameworks for studying close relationships in adolescence and adulthood is attachment theory, a theory originally developed by Bowlby and Ainsworth to explain human infants' emotional attachment to their caregivers (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969/1982; see Fraley & Shaver, 2000 and Mikulincer & Shaver, 2003, for an overview of the theory as applied to adult relationships). According to Bowlby (1969/1982), humans are born with an innate behavioural system, the attachment behavioural system, which ensures that people of all ages, but especially young children, will seek safety, protection, and support from selected other people (''attachment figures'') when threatened, injured, or ill. Ainsworth and her colleagues (1978) identified systematic patterns of attachment in infancy that seemed to result from certain kinds of parenting.

Hazan and Shaver (1987) found similar patterns among adults in the context of romantic and marital relationships. These patterns have since been shown to

be reducible to two major dimensions, attachment-related anxiety and attachment-related intimacy avoidance (e.g., Brennan, Clark, & Shaver, 1998). Relatively stable individual differences on these two dimensions have been related in theoretically predictable ways to a wide variety of cognitive, affective, and behavioural variables (see Feeney, 1999, and Mikulincer & Shaver, 2003, for reviews). Although there has been some disagreement in the literature about appropriate ways to measure these dimensions, a large and growing literature supports the use of two self-report dimensions (e.g., Shaver & Mikulincer, 2002a, 2002b).

Here, we are particularly interested in the relative absence of certain positive behaviours and qualities in avoidant individuals' close relationships. For example, avoidant individuals report experiencing fewer positive emotions (Searle & Meara, 1999) and rate everyday social interactions as boring and unengaging (Tidwell, Reis, & Shaver, 1996). They do not approach situations where self-disclosure is (for most people) appropriate, normative, and rewarding, nor do they approve of others' self-disclosures (Anders & Tucker, 2000; Mikulincer & Nachshon, 1991). In stressful situations, avoidant individuals exhibit fewer caregiving behaviours and offer less support to their romantic partners (Feeney & Collins, 2001; Fraley & Shaver, 1998). During the Gulf War, avoidantly attached Israelis who lived in the most dangerous areas were more likely than nonavoidant individuals to use distancing, self-reliant coping strategies rather than seeking social support and comfort from close relationship partners (Mikulincer, Florian, & Weller, 1993).

Avoidant individuals do not show increases in creative thinking following a positive mood induction, as is common among secure individuals (i.e., Isen & Daubman, 1984; Mikulincer & Sheffi, 2000). Moreover, when primed (i.e., shown a stimulus so briefly that its appearance is not consciously perceived) with an attachment-related threat word (e.g., ''separation''), avoidant individuals *inhibited* activation of their attachment figures' names. For nonavoidant individuals, the pattern of results was exactly the opposite: Responses to the names of attachment figures were facilitated by an attachment-related threat word (Mikulincer, Gillath, & Shaver, 2002). These findings indicate that while nonavoidant individuals automatically activate mental representations of their attachment figures in times of threat, avoidant individuals, even on a pre-conscious level, steer clear of this kind of mental representation, at least when the issue of separation has been raised.

These findings illustrate two key features of the emotional and behavioural lives of avoidant individuals: (1) In their close relationships, they experience both less positivity and more negativity; and (2) they exhibit both fewer approach behaviours and more withdrawal behaviours.

Valenced emotional dispositions and patterns of approach/withdrawal behaviour are associated not only with patterns of adult attachment. In recent years, neuroscientists have begun to explore how the two cerebral hemispheres

differentially process emotion-related information (see Davidson, Jackson, & Kalin, 2000, for a review). Researchers have not come to consensus on the best way to characterize these hemispheric asymmetries (Cacioppo & Gardner, 1999; Davidson & Irwin, 1999), but the gist of the findings is that emotions related to or caused by appetitive or approach motives are associated with greater activation in the left prefrontal cortex, whereas emotions related to or caused by avoidance or withdrawal motives are associated with greater activation in the right prefrontal cortex. We do not propose to resolve disagreements within that research area. Rather, we wish to use the general distinction, which is well documented, to investigate how individual differences in avoidant attachment relate to hemispheric differences in the processing of attachment-related information.

Davidson et al. (2000) highlight the association between the right prefrontal cortex, withdrawal behaviours, and negative emotion, and between the left prefrontal cortex, approach behaviours, and positive emotion in psychologically and neurologically normal human subjects. For example, film-induced positive mood increased electrical activity over the left prefrontal region and film-induced negative mood increased electrical activity over the right prefrontal region (Davidson, Ekman, Saron, Senulis, & Friesen, 1990). This pattern of results has been found using neuroimaging techniques such as functional magnetic resonance imaging (fMRI) (Canli, Desmond, Zhao, Glover, & Gabrieli, 1998), EEG (Jones & Fox, 1992; Schutter, Putmaa, Hermans, & van Honk, 2001), and positron emission tomography (PET) (Sutton, Ward, Larson, Holden, Perlman, & Davidson, 1997); behavioural measures of reaction time (Bernat, Bunce, & Shevrin, 2001; Burton & Levy, 1991; Eviatar & Zaidel, 1991; Richards, French, & Dawd, 1995); and studies of brain damaged patients (Gainotti, 1972; Morris, Robinson, Raphael, & Hopwood, 1996; Sackeim et al., 1982; Wiedemann et al., 1999).

Given that negative emotions and withdrawal tendencies are associated with the right frontal cortex, it seems likely that avoidant attachment is a reflection of particular kinds of processing in that hemisphere of the brain. Avoidant individuals should be either more adept at processing negative attachment-related information or less adept at processing positive attachment-related information in the right hemisphere. The latter prediction is compatible with the extensive evidence reviewed above indicating that avoidant individuals fail to react positively to various kinds of positive affect inductions, fail to become engaged in social interactions, and fail to seek support from others when under stress.

Testing asymmetry in the brain

In order to explore attachment and hemispheric differences in emotion processing, we can take advantage of the fact that stimuli presented to one visual hemifield are first processed by the opposite hemisphere. For example, an image

presented to the right side of a person's visual field will first enter the primary visual area in the left hemisphere. By briefly presenting a stimulus on one side (e.g., the left side) of a fixation point, we can ensure that the stimulus is processed first by the contralateral, or opposite, hemisphere (in this case, the right hemisphere). Experimentally, this phenomenon can be used in a divided visual field task. Divided visual field tasks are commonly used in the cognitive sciences to investigate how quickly and accurately different hemispheres process information. Typically, the task involves brief presentations of letter strings or images in either visual field. A participant makes a decision about that stimulus and responds using a keyboard or response box. This task is useful for studying how different kinds of emotional and attachment-related information are processed. Words that convey certain meanings and connotations can be presented to a particular visual field to be processed first by the contralateral hemisphere.

In the study reported here, we wanted participants to be thinking about attachment-related issues so that their attachment systems would be engaged and attachment-related material in memory would be primed. We therefore had them write about attachment-related issues for 5 minutes before performing the divided visual field task.

Study overview and hypotheses

Participants completed dispositional measures of attachment anxiety and attachment avoidance, which we expected to be related to hemispheric asymmetry, and were then primed to think about attachment issues in the following way. Half of them wrote about a secure attachment figure (someone they love very much, who is always there for them and is responsive to their needs) and half wrote about an attachment threat: abandonment (someone they love very much, suddenly and without explanation, leaving them for someone else). These priming manipulations were expected to make positive or negative attachment-related experiences temporarily more available in memory.

Our first hypothesis was that responses to emotionally valenced words would be lateralised in a pattern consistent with hemispheric asymmetry models; specifically, the right hemisphere would have a negative word advantage and the left hemisphere would have a positive word advantage. This difference was expected to appear in all experimental conditions. The second hypothesis was that the attachment prime would increase the availability of related verbal information, because thinking about a positive attachment situation (a loving, supportive attachment figure) would facilitate responses to related positive words, whereas thinking about a negative attachment situation (abandonment) would facilitate responses to related negative words. This effect was expected to occur independently of other experimental manipulations. The third hypothesis was that attachment-related avoidance would be associated with either a right

hemisphere advantage for processing negative attachment-related words or a right hemisphere disadvantage for processing positive attachment-related words. If obtained, this finding would support the possibility that the psychological and behavioural correlates of avoidant attachment are related to differences in the way the two cerebral hemispheres process information.

METHOD

Participants

Participants were 129 (83% female) undergraduate students enrolled in introductory psychology courses.[1] They participated in exchange for extra credit. Mean age was 19.6 years. All participants were self-described as right-handed.

Procedure

After reading and signing informed consent documents, participants were seated in front of a computer and completed questionnaires regarding demographic information, the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988), and the Experiences in Close Relationships scale (ECR; Brennan et al., 1998), which includes the self-report dispositional attachment avoidance scale used in the present analyses. The ECR scale has been used in scores of previous studies, which provide strong evidence for its construct validity, and it consistently yields internal consistency reliability coefficients above .90.[2] Participants were then primed for attachment security or separation, and given the divided visual field task. The PANAS was included to test the alternative hypothesis that the predicted results were attributable to dispositional differences in mood rather than differences in attachment-related avoidance.

Attachment prime.   Following completion of these questionnaires, participants were randomly assigned to the secure prime or the separation prime. In both conditions, participants were instructed to think about someone, or imagine

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[1] We initially included sex (men vs. women) in all the analyses reported in this paper, but no significant main effects of sex or interactions of sex with other independent variables were found, so we combined data for men and women in all analyses.

[2] There are two major ways to assess adult attachment style, using either the Adult Attachment Interview (reviewed by Hesse, 1999), which focuses on memories of an interviewee's childhood relationships with parents, and self-report scales such as the ones used here, which focus on adult close relationships. The relation between these two kinds of measures and the meanings of both have been extensively reviewed by Crowell, Fraley, and Shaver (1999), Shaver, Belsky, and Brennan (2000), and Shaver and Mikulincer (2002a, 2002b). In the present study we were primarily interested in participants' current representations of their attachment orientations in adult close relationships, so we used the most reliable and well-validated of the self-report scales designed for that purpose. A comprehensive summary of research using this kind of measure has been provided by Mikulincer and Shaver (2003).

someone, they love very much who is always there for them and to whom they can always turn in times of need. In the separation priming condition, participants were given additional instructions to imagine that this person suddenly and without any explanation leaves them for someone else. Participants in both conditions were instructed to write a few paragraphs about how they felt about this person and his or her actions. This priming procedure took approximately 6 minutes. If participants were not writing or were writing for too long, they were encouraged to complete the task and then continue with the experiment.

Divided visual field task. Following the priming procedure, participants were given the divided visual field task. All participants were seated with their eyes approximately 60 cm from the monitor. They were instructed to keep their head still throughout the procedure. If participants moved or shifted, the experimenter encouraged them to maintain posture.

Stimuli. These were 324 words that were matched for number of letters, number of syllables, frequency, and age of acquisition (the latter two were obtained using the Medical Research Council [MRC] psycholinguistic database). All words were positively or negatively valenced, and were grouped into one of five categories: attachment-related, emotion, verb, concrete noun, or adjective. A pilot study ($N = 41$) was conducted to determine, based on a 7-point scale, how affectively positive or negative each word was. Based on this study, words that were ambiguous (i.e., not clearly positive or negative as indicated by mean ratings below 2.1 or above 5.9) were discarded, reducing the word list to 200 words. Examples of words in each category are provided in Appendix 1.

Task. Each trial began with a fixation stimulus (the letter ''X'') appearing at the centre of the screen for 600 ms. This X remained on the screen throughout the procedure, and participants were instructed to keep their gaze fixated on that point. After 600 ms, two stimuli appeared, one to the left and one to the right of the X. One of these stimuli was the target stimulus (a word) and the other was a distracter stimulus (XXXXXX). The purpose of the distracter was to prevent automatic gaze-shifting to a lone word by having stimuli appear in the same area in both visual fields for the same amount of time. These stimuli remained on the screen for 165 ms. (Desmurget et al., 2001, have shown that automatic gaze shifts do not occur in less than 200 ms.) Each stimulus was 15–25 mm long, 7 mm high, and 12 mm from fixation, thus subtending approximately 2.2° of visual arc. After 165 ms the stimuli disappeared and participants made a response to the word using the keyboard. They were instructed to respond by pressing either the ''m'' or ''n'' key, depending on whether the stimulus named something ''good'' or ''bad''. (The assignment of good and bad to the two different keys was counterbalanced across participants.) Half of the participants

responded with the index finger of their right hand, and half with the index finger of their left hand. This is a common procedure in divided visual field experiments because different hands can have different response times, especially when the task involves language. Each target word was presented once to each hemisphere, and the order of word presentation varied randomly across participants.

Data analyses.   The dependent measure was accuracy, defined as the proportion of responses correctly categorised as positive or negative. We chose to focus on accuracy and not reaction time (the latency between stimulus onset and keyboard response) because Prinzmetal, McCool, and Park (2003) have suggested that accuracy and reaction time index different cognitive mechanisms; specifically, reaction time indexes automatic processes (e.g., attentional shifts or orienting responses) and accuracy indexes decisions about stimuli. In our experiment, accuracy was expected to provide better insights into the complex decision processes in which we were interested.

For each participant, scores were averaged for each word category (e.g., positively valenced emotion-related words presented to the right hemisphere—left visual field). Mean proportion correct was 0.70 with a standard deviation of 0.10. Trials with response times greater than 3 standard deviations above the mean were deleted from analyses.

For all analyses except the one involving individual differences on the continuous dispositional avoidance scale, we used repeated-measures mixed-design ANOVAs. The within-subjects factors were hemisphere of stimulus presentation, valence of stimulus, and word category. The between-subjects factors were priming condition and response hand. The third hypothesis was tested using regression analyses that included the continuously scored avoidance dimension. Five participants did not complete the attachment measures and so were not included in the regression analyses.

RESULTS

In order to test our first hypothesis, that the brain is lateralised with respect to valenced word processing, we conducted a 2 (hemisphere of presentation) $\times$ 5 (word type) $\times$ 2 (valence) repeated-measures ANOVA with priming condition as a covariate. There were no interactions involving priming condition.

There was a significant hemisphere $\times$ valence interaction, $F(1, 127) = 57.04$, $p < .001$, and a hemisphere $\times$ word type $\times$ valence interaction, $F(1, 127) = 2.58$, $p < .05$. Means and standard errors for these interactions are displayed in Table 1. In addition, we found that subjects were more accurate at categorising words first presented to the left hemisphere than those presented to the right hemisphere, $F(1, 127) = 63.17$, $p < .001$, and were less accurate at categorising verbs, $F(1, 127) = 17.13$, $p < .001$. Overall, these results support the idea that the

TABLE 1
Lateralisation of emotion and attachment words

Category	Left hemisphere		Right hemisphere	
	Positive	*Negative*	*Positive*	*Negative*
Emotion	0.78 (0.013)	0.74 (0.016)	0.64 (0.018)	0.75 (0.014)
Attachment	0.76 (0.012)	0.70 (0.016)	0.62 (0.015)	0.72 (0.013)
Adjective	0.77 (0.014)	0.75 (0.015)	0.62 (0.016)	0.73 (0.015)
Verb	0.72 (0.012)	0.69 (0.015)	0.60 (0.015)	0.71 (0.013)
Noun	0.74 (0.014)	0.71 (0.015)	0.62 (0.016)	0.69 (0.015)

Note: Numbers outside parentheses are mean categorisation accuracies (in proportions), those inside parentheses are standard errors.

two cerebral hemispheres are lateralised for valenced word processing: When words were presented to the left hemisphere, accuracy was greater for positive than negative words; when words were presented to the right hemisphere, accuracy was greater for negative than positive words.

To test the second hypothesis, that the attachment prime would spread activation to related semantic concepts (attachment-related words),[3] a 2 (prime) × 2 (word valence) × 2 (hemisphere of presentation) repeated-measures ANOVA was conducted for each response hand (half the subjects responded with the right hand and half with the left). There were significant interactions between word valence and hemisphere (see results for Hypothesis 1), but no three-way interactions involving hemisphere or two-way interactions between hemisphere and prime.

For attachment words and participants who responded with the right hand, the results supported the second hypothesis. The word valence × condition prime interaction was significant, $F(1, 59) = 5.98$, $p < .02$. As expected, in the secure priming condition, responses to positively valenced attachment-related words were somewhat more accurate than responses to negatively valenced attachment-related words (0.71 and 0.66, respectively), and in the separation priming condition, responses to negatively valenced attachment-related words were somewhat more accurate than responses to positively valenced attachment-related words (0.73 and 0.69, respectively). For participants responding with their left hand, no differences approached significance. The difference between left- and right-handed responding will be considered further in the Discussion section.

The third hypothesis was that avoidant attachment would be associated with a right hemisphere advantage for processing negative attachment-related words or

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[3] Hypothesis 2 focused specifically on attachment-related words, so results for that word category are the only ones reported in detail. However, we also conducted exploratory analyses for the other word types and obtained no significant effects.

a right hemisphere disadvantage for processing positive attachment-related words. We first examined the effect of dispositional attachment avoidance on categorisation accuracy for negative attachment words in the right hemisphere, and the result was not significant, $t(123) = -0.30$, n.s.). This indicates that avoidance is not associated with improved processing of negative attachment-related words in the right hemisphere. Next, we examined the effect of attachment avoidance on categorisation accuracy for positive attachment words in the right hemisphere. A linear regression analysis supported this part of the hypothesis, $\beta = -.22$, $t(123) = -2.40$, $p < .02$. The same regression analysis was conducted for all other word categories and none produced significant effects except positive adjectives in the right hemisphere, $\beta = -.20$, $t(123) = -2.28$, $p < .03$.

In order to make sure that the apparent effect of avoidance on positive attachment-related words processed in the right hemisphere was actually due to attachment avoidance and not some other variable, we twice recomputed the analysis with additional variables included. In the first block of the first equation, we entered condition (attachment prime) and response hand; in the second block, attachment avoidance. Neither of the predictors in the first block was significant, and attachment avoidance remained significant, $\beta = -.22$, $t(123) = -2.47$, $p < .02$. In the second analysis, we tested the alternative hypothesis that this effect was due to dispositional mood, as measured by the PANAS. In the first block of the analysis, we entered negative affect and positive affect. Neither of these predictors was significant. On the next step, attachment avoidance entered and still proved to be a significant predictor, $\beta = -.19$, $t(123) = -2.00$, $p < .05$.

Next, we followed the same procedure for accuracy of categorising positive adjectives in the right hemisphere. After entering condition and response hand in the first block and avoidance in the second block, there were no significant effects: for avoidance, $\beta = -.07$, $t(123) = -0.82$, n.s. Next, we entered negative affect and positive affect in the first block, and attachment avoidance in the second block. Negative affect significantly predicted accuracy, $\beta = -.20$, $t(123) = -2.23$, $p < .03$, and avoidance did not, $\beta = -.14$, $t(123) = -1.58$, n.s. Thus, only avoidance had an independent effect on attachment-related words, and it did not have an effect on any of the other kinds of words.

DISCUSSION

Our first hypothesis was supported. Consistent with affective-motivational models of hemispheric asymmetry, we found a left hemisphere advantage for categorisation accuracy when processing positive emotion and attachment-related words, and a right hemisphere advantage for processing negative emotion and attachment-related words. These differences were larger in the right hemisphere. This is consistent with the fact that some behavioural studies of

emotional lateralisation find effects only for the right hemisphere (Atchley, Ilardi, & Enloe, 2003; Richards et al., 1995), while others find effects in both hemispheres (Bernat et al., 2001; Burton & Levy, 1991; Eviatar & Zaidel, 1991). This may reflect the fact that the right hemisphere is slower overall at language processing than the left hemisphere, and thus differences that exist equally in both hemispheres appear larger in the right hemisphere in tasks that involve language comprehension and decisions. It is also possible that the linguistic representation of emotion is not as strongly lateralised as other behavioural or response-related representations.

The second hypothesis, that writing about attachment issues would increase the availability of affectively related attachment information, was partially supported. When the participants were broken down into two groups—those who had responded with their left hand and those who had responded with their right hand—those who had responded with their right hand showed a pattern of results consistent with the hypotheses, whereas those who had responded with their left hand showed no differences. This may be due to a number of factors. First, the right hand is controlled by the left hemisphere, which is dominant for language production. Our prime was a language-intensive one (writing for approximately 5 minutes), so one would expect the left hemisphere to be more strongly primed than the right hemisphere, which has very limited language production capabilities. Second, Koivisto (1998) has suggested that the right hemisphere is not sensitive to immediate priming effects, but shows priming effects later (i.e., post-lexical judgement). Our task demanded very rapid responses and thus may not be capable of detecting right hemispheric priming effects. Third, although semantic priming has been shown to occur in the right hemisphere (Chiarello, Burgess, Richards, & Pollock, 1990; Chiarello & Richards, 1992; Long & Baynes, 2002), these studies show that the right hemisphere is sensitive to priming for distantly related but not proximally related words (Chiarello, Maxfield, Liu, & Kacinik, 2001; Chiarello & Richards, 1992). Since the words used in our study were closely related to positive and negative attachment issues, it is possible that the priming manipulation was a proximal one, and thus did not affect the right hemisphere (which controls left-handed responses).

The third hypothesis stated that dispositional attachment avoidance would be associated with either a right hemisphere advantage for processing negative attachment information or a right hemisphere disadvantage for processing positive words. The latter part of this hypothesis was supported: While there was no advantage for processing negative words in the right hemisphere, attachment avoidance was significantly associated with a *disadvantage* for processing positive words in the right hemisphere. Furthermore, attachment avoidance predicted lower scores on positive attachment words in the right hemisphere even after partialing out the effects of response hand, priming condition, negative affect, and positive affect.

We will consider two possible reasons for this effect. First, it is important to remember that although the visual information was presented to only one hemisphere, both hemispheres participated in the response decisions because information travels rapidly between the two hemispheres via the corpus callosum. Perhaps for individuals who score higher on attachment avoidance, positive attachment-related information does not transfer across the hemispheres as rapidly as other kinds of information, which reduces accuracy.

Second, individuals who score relatively high on measures of dispositional avoidance may differ from individuals who score low in the way they represent or make judgements about positive attachment information in the right hemisphere. Perhaps this kind of information is less well represented, or decision-making processes based on such information are more difficult when the information is presented to the right hemisphere. This interpretation is consistent with behavioural evidence that avoidance predicts less experience and expression of positive emotions (Searle & Meara, 1999; Tidwell et al., 1996). In the brain, this effect may originate from poorly represented positive attachment information networks in the right hemisphere, the hemisphere that is overall less efficient at processing positive emotional information.

Unfortunately, too little is known about how the right hemisphere processes language and how lexical good-bad decisions are made to explain fully why more avoidant individuals are less accurate at categorising positive attachment-related words in the right hemisphere. The procedures we used and the data we collected do not allow us to answer this important question. This finding is consistent, however, with the way avoidant individuals behave in their close relationships. As discussed in the Introduction, avoidant individuals often fail to approach positive situations, such as those that involve intimate self-disclosure or imaginative rehearsal of affectively positive imagery and memories. Here, we have shown that an attachment prime and individual differences in attachment avoidance influence how the brain processes linguistic information in ways that are theoretically consistent with both attachment theory and theories of emotion-related hemispheric asymmetries.

Limitations and future directions

Our experiment was a preliminary investigation of how self-reported dispositional attachment avoidance moderates differences in the way the two hemispheres of the brain process positive attachment-related words. Although our preliminary findings are encouraging, methodological limitations should be considered when interpreting the results. First, a divided visual field task can be an imprecise measure of hemispheric asymmetries. Although information is presented to only one hemisphere, information travels rapidly throughout the brain (via the corpus callosum and other structures), and what is presented to one hemisphere can be processed in part by the other hemisphere. Further research

would be required to localise precisely the brain regions responsible for the differences we obtained. Previous research suggests that the prefrontal cortex is the seat of this lateralisation (Davidson & Irwin, 1999; Davidson et al., 2000), but our experiment does not allow us to determine the location responsible for our effects.

Future experiments exploring hemispheric asymmetries related to patterns of adult attachment should utilise other methods, such as electroencephalography (EEG), or neuroimaging techniques, such as functional magnetic resonance imaging (fMRI). In general, our findings suggest differences in the processing of attachment-related information in the brains of individuals who are high on attachment avoidance compared to those who are low. These differences may be important in understanding the nature of avoidance in close relationships.

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APPENDIX 1
Examples of words in each category

Word categories	Examples				
Positive emotion	happiness	cheerful	joyous	delighted	peaceful
Negative emotion	afraid	scared	ashamed	sadness	depressed
Positive attachment	affectionate	caring	intimate	supportive	loved
Negative attachment	abandon	clingy	cynical	deceptive	desperate
Positive noun	cookie	daisy	flower	treasure	kitten
Negative noun	rodent	accident	battle	sewer	blood
Positive verb	applaud	compliment	entertain	dance	approve
Negative verb	destroy	accuse	whine	hate	criticize
Positive adjective	artistic	assertive	handsome	brave	creative
Negative adjective	crude	cruel	corrupted	dirty	disgruntled