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# Influence of adult attachment style on the perception of social and non-social emotional scenes

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**Abstract**

Attachment theory describes how people emotionally bond with others, utilize their social interactions to regulate affective needs, and how they differ in their attachment style. However, it remains unknown whether anxious or avoidant attachment is linked to more general differences in emotional processing for negative and positive stimuli, and whether such differences depend on stimulus content. Here we tested how social or non-social positive or negative emotional scenes were rated for pleasantness, arousal, and control, as a function of individual attachment style, in a sample of 54 female participants. Our results show that avoidant attachment was associated with a selective reduction of pleasantness ratings for positive social images, whereas anxious attachment was associated with higher arousal and lower control ratings for negative social images, besides higher arousal ratings for all remaining stimulus categories. These findings reveal that adult attachment style is associated with differences in the perception of emotion-laden stimuli, even when unfamiliar and not directly attachment-related, and such differences may also affect positive scenes, particularly when they contain social information, rather than just socially negative or threatening information. In addition, our results support the notion that anxious attachment is not only associated with hyperactivating tendency during the appraisal of social threat, but may

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also involve an ambivalence influencing the judgments of both positive and negative information.

**Keywords**
Adult attachment style, emotion processing, arousal versus control versus pleasantness, social versus non-social, positive versus negative

Based on the early discovery of different attachment patterns in infants (Ainsworth, 1978; Bowlby, 1969, 1982), researchers have identified distinct attachment styles that characterize individual differences in social interactions and emotional responses to others (Bartholomew & Horowitz, 1991), extending even during adulthood and for novel encounters with strangers (Fraley, Niedenthal, Marks, Brumbaugh, & Vicary, 2006). Four different attachment styles are typically distinguished: secure, anxious-preoccupied (AX), dismissive-avoidant (AV), and fearful-avoidant/disorganized (the latter category will not be further considered in the present study as it combines features of both AV and AX). These categories are nowadays preferentially described by a bi-dimensional model (Brennan, Clark, & Shaver, 1998; Griffin & Bartholomew, 1994), according to which attachment security corresponds to low scores on both AV and AX, characterized by positive and trustful social interactions. Conversely, AX implies a strong need for closeness, worries about relationships, and fears of rejection, whereas AV involves a preference for self-reliance and emotional distance from others. The latter behaviors are reflected in so-called secondary attachment strategies, entailing either a hyperactivation of the attachment system in the case of AX, or deactivation strategies in the case of AV (Mikulincer & Shaver, 2007).

According to the *control systems model* of the attachment system in adulthood (Mikulincer & Shaver, 2003), three main components underlie the functioning of the attachment system. A first component is responsible for activation of the attachment system through the monitoring and appraisal of signs of social threat. A second component involves the monitoring and appraisal of the availability of an attachment figure, which is normally associated with felt security. Finally, a third component involves the regulation of proximity-seeking as a way of dealing with perceived attachment insecurity, which is tantamount with emotion regulation, and operates by either hyperactivating or deactivating the attachment system. Hyperactivation is associated with AX, whereas deactivation is associated with AV. Importantly, this model includes reciprocal influences between components, such that a recurrent use of hyperactivating or deactivating strategies can affect the appraisal of social threats (first component) and of attachment-figure availability (second component). As a consequence, anxiously attached people – who employ hyperactivating strategies and maintain the attachment system in a chronically active state – also tend to exhibit heightened reactivity and enhanced attention towards threatening events (Mikulincer & Shaver, 2007). In turn, avoidantly attached people – who tend to use deactivating strategies and maintain their attachment system in a down-regulated state – may ignore or dismiss threatening events, and deny the need for an attachment figure (Mikulincer & Shaver, 2007).

Recent neuroimaging investigations have provided some support for these distinctions. Although few studies exist to date, the available results suggest that individual differences in the functioning of the first component of the control system model of attachment might involve brain areas critically associated with emotional processing, such as the amygdala, ventral striatum, insula, or anterior cingulate cortex (Dewall et al., 2012; Lemche et al., 2006; Strathearn, Fonagy, Amico, & Montague, 2009; Vrtička, Andersson, Grandjean, Sander, & Vuilleumier, 2008), whereas differences in the other two components of the model might involve prefrontal regions associated with emotion regulation and social conflicts (Gillath, Bunge, Shaver, Wendelken, & Mikulincer, 2005; Vrtička et al., 2008), as well as somatosensory areas responsible for emotional contagion and recognition (Suslow et al., 2009). In addition, the notion of a bi-dimensional organization of the attachment system also accords with findings that AX correlates with stronger response to negative social stimuli (e.g., angry faces or negative verbal scenarios) in the amygdala (Lemche et al., 2006; Vrtička et al., 2008), a region associated with fear and personal relevance (Phelps & LeDoux, 2005; Sander, Grafman, & Zalla, 2003), while conversely, AV correlates with weaker response to positive social stimuli (smiling faces) in the ventral striatum and ventral tegmental area (Strathearn et al., 2009; Vrtička et al., 2008), two regions critically involved in reward and addiction (Schultz, 2006).

In the present study, we investigated emotional processes linked to the first component of the *control systems model*, and tested whether individual differences in attachment style are associated with distinct patterns of conscious appraisal for emotional information with or without social significance. According to attachment theory, the attachment system is activated in threatening conditions, but the triggering events could be either attachment-related (e.g., the loss of a loved one) or attachment-unrelated (e.g., receiving a frightening medical diagnosis). Indeed, any distress-eliciting material may activate representations and needs for social proximity and protection (Dewitte, De Houwer, Koster, & Buysse, 2007; Mikulincer, Gillath, & Shaver, 2002; Mikulincer, Shaver, & Pereg, 2003; Pereg & Mikulincer, 2004). However, despite abundant research on attachment system activation in social situations, very few studies have investigated the monitoring and processing of more general emotional material. Hence, it remains unclear whether individual differences in attachment style influence conscious emotional appraisal for attachment-related and/or negative information only, or whether they might also be linked to differences in the processing of attachment-unrelated and positive information. Moreover, although attachment style has been found to correlate with differential activation in brain areas associated with threat and reward processing, most brain imaging studies used face stimuli (Strathearn et al., 2009; Suslow et al., 2009; Vrtička et al., 2008) or sentences/scenarios with attachment-related meaning (Dewall et al., 2012; Gillath et al., 2005; Lemche et al., 2006). It therefore remains unknown whether such differences in affective responses would extend to other (e.g., non-social) material, and whether they would translate into differences in subjective emotional judgments measurable at the behavioral level. Furthermore, attachment style has also been linked with individual differences in neuroendocrine systems regulating responses to stress (Kidd, Hamer, & Steptoe, 2011; Quirin, Pruessner, & Kuhl, 2008), as well as with distinct genotypes controlling expression of receptors for dopamine and serotonin (Gillath, Shaver, Baek, & Chun, 2008), suggesting that emotional reactivity and regulation could be more broadly affected. Here, we therefore aimed at investigating whether attachment style might

involve more general differences in emotional judgments for negative and positive scenes, and whether such influences might depend on the scene content, beyond faces or attachment-related material.

Previous behavioral studies investigating emotional processes in relation to attachment have generally focused on indirect or implicit measures, rather than explicit emotion appraisals. In particular, several studies examined vigilance or attentional monitoring in relation to the affective meaning of verbal material or facial expressions. For instance, some authors (Mikulincer et al., 2002) reported that highly anxiously attached people were faster to make lexical decisions in response to the names of their attachment figures. Other investigations used a classic dot-probe paradigm (Dewitte, De Houwer, et al., 2007; Dewitte, Koster, De Houwer, & Buysse, 2007) and found that AX was associated with hypervigilance toward attachment names, while an attentional bias away from general threat-related words correlated with both AV and AX. These results converge to suggest that attentional processing may differ as a function of secure (low AV and AX) versus insecure (high AV and high AX) attachment (Kirsh & Cassidy, 1997; Van Emmichoven, Van Ijzendoorn, De Ruiter, & Brosschot, 2003), but these effects could result from differential responsiveness at either the appraisal or the regulatory stage in the control systems model of attachment (Mikulincer & Shaver, 2007). Moreover, attention can be automatically captured by threat-related stimuli even in the absence of negative evaluation in explicit or implicit emotional judgments (Purkis & Lipp, 2007).

Other studies (Fraley et al., 2006; Niedenthal, Brauer, Robin, & Innes-Ker, 2002) examined how anxiously and avoidantly attached individuals react to the onset, as well as the offset, of different emotional facial expressions in a morph movie paradigm. Fraley et al. (2006) found that highly anxiously attached subjects perceived both the *onset* and the *offset* of positive and negative emotional facial expressions at earlier time-points relative to people who were less anxiously attached. No specific pattern was observed for avoidantly attached people. On the other hand, Niedenthal et al. (2002) reported that, under normal conditions, AV and AX were associated with a later detection of the *offset* of both happiness and anger expressions, as compared to secure attachment. No differences were found for sadness expressions. Although these findings point to some modulation of emotion perception and judgment by attachment styles as a function of specific stimulus content, they remain partly divergent and do not inform about potential differences in affective responses to attachment-unrelated cues. Furthermore, all of the above-mentioned studies – investigating vigilance, attentional monitoring, or detection threshold – used reaction time paradigms and, therefore, mainly assessed implicit or relatively automatic attachment processes. They do not inform about differences in more explicit, controlled attachment mechanisms. To our knowledge, only one study examined explicit emotion ratings for video-clips with attachment-related content (Rognoni, Galati, Costa, & Crini, 2008) and showed that anxiously attached individuals reported negative emotions of fear and sadness as more arousing as compared with securely attached individuals; avoidantly attached individuals reported positive emotions as less arousing than the other two groups. Even though this study suggests an effect of attachment system activation on emotional appraisal, it did not distinguish between responses to events with social versus non-social content.

Given the above evidence suggesting disparity in the processing of emotional information, particularly from social stimuli such as unfamiliar faces, as well as variance in brain systems and genetic factors associated with general emotion functions, the present study asked whether individual differences in attachment style might also be linked to dissimilarities in the appraisal of emotional information in visual scenes with no direct attachment-related meaning, but with distinct social or non-social content, and either positive or negative valence. Firstly, this allowed us to investigate emotion appraisal beyond previous behavioral and neuroimaging work that used only faces, names, or words with an attachment-specific meaning. Secondly, by manipulating the content of visual stimuli in a systematic and orthogonal manner, we could determine the specificity of attachment processes related to the social or non-social nature of emotional events, as well as to their threatening or non-threatening nature. Note, however, that our stimuli made no direct reference to personal attachment figures (e.g., parents or romantic partners) or specific attachment concepts (e.g., love or trust), but rather probed for any effect reflecting an activation of the attachment system when processing more general social information (e.g., unfamiliar people or interactions). Finally, by using an explicit rating task, our study could also clarify whether only automatic attention and vigilance mechanisms are influenced by secondary attachment strategies, or whether more conscious interpretation and judgment processes are also involved in differentially shaping emotion responses as a function of attachment style. We used a standard procedure to assess basic dimensions of affect, which is widely used in emotion research (Lang, Bradley, & Cuthbert, 1999), and required participants to rate each visual scene on three standard scales: pleasantness, arousal, and subjective control. Whereas pleasantness and arousal ratings reflect a representation of intrinsic stimulus properties, control refers to a more complex judgment of felt dominance over one's emotional response and mainly reflects emotion regulation capacities.

## Methods

### Participants

We recruited 57 participants from second-year psychology students at Geneva University (55 women, $M_{age} = 23.57$ years). Since there were only two males, we restricted our final analyses to women in order to ensure a homogenous sample and avoid any effect of gender differences related to emotion regulation (Fujita, Diener, & Sandvik, 1991; Kim & Hamann, 2007). Data from one female participant had to be removed because of an incoherent response pattern (final $N = 54$).

### Attachment questionnaire

Attachment style was assessed with a translated and validated French version (Guedeney, Fermanian, & Bifulco, 2010) of the Relationship Scales Questionnaire (RSQ; Griffin & Bartholomew, 1994) and analyzed according to recent recommendations of Kurdek (2002). This method applies a bi-dimensional model of attachment (Simpson, Rholes, & Nelligan, 1992) using 13 of the original 30 items of the RSQ, and has been found to yield psychometrically reliable scores of attachment styles, particularly if compared to the attachment

interview (Kurdek, 2002, p. 831). Although other scales exist to assess attachment style, such as the ECR (Fraley, Waller, & Brennan, 2000), the RSQ items were selected for consistency with our previous work (Vrtička, 2008; Vrtička, Sander, & Vuilleumier, 2012) and because of their validation by others (e.g., Kurdek, 2002). Participants completed the questionnaire several weeks before the experiment together with other measures of personality.

### Stimuli and ratings

We collected 360 emotional pictures from the "International Affective Pictures System" (IAPS; Lang et al., 1999) and the internet, which were sorted by *social content* (social or non-social) and *valence* (positive or negative). This gave rise to four conditions: Social Positive (SP) or Negative (SN), plus Non-social Positive (NSP) or Negative (NSN). Pictures belonging to the *social* category displayed scenes generally depicting two or more individuals, such as two people fighting (negative valence) or playing together (positive valence). In contrast, images belonging to the *non-social* category depicted scenarios with no people directly involved, such as a dead bird covered in oil (negative valence) or a tropical island scene (positive valence). All social images were carefully chosen to imply some form of interpersonal interaction, but without a direct attachment-related meaning or any reference to personally relevant situations. All pictures were presented in color and appropriately adjusted to obtain similar low-level properties (e.g., size, luminance, and pixel resolution).

### Procedure

From the entire image set, two separate lists of 180 pictures were generated, each including 45 pictures per experimental condition. Participants had to rate all emotional pictures from one list in two sessions, each lasting approximately 15 minutes, with a break of several minutes in between. Each picture was presented on a computer screen for 3 seconds, followed by a rating screen that remained visible until a response was made. Since there were no significant differences between rating scores for the three ratings scales between the two lists, our subsequent analysis pooled the rating responses across all 360 emotional pictures and all subjects, with participant as the only random factor.

Ratings were made on a visual continuous scale (from 0 to 100) according to three basic dimensions of affect that are known to reflect important features of all emotions (Bradley & Lang, 1994): *pleasantness* ("How did you feel when seeing the last image?", from "very negative" to "very positive"); *arousal* ("How physically aroused or calm did you feel when seeing the last image?", from "low" to "high" subjective arousal); and *control* ("To what extent were you able to control the induction of emotion by the previous picture?", from "absence of control" to "presence of control").

## Results

### Relationship Scales Questionnaire

Mean scores were 19.08 $\pm$ 4.97 for AV and 10.96 $\pm$ 3.92 for AX, corresponding to previous findings in healthy controls (Kurdek, 2002). There was a mild positive

association between AV and AX [$r = .24$, $p < .10$]. Cronbach's alpha values were .79 for AV (eight items) and .84 for AX (five items).

## Subjective ratings

Prior to analysis, the two raw scores from the attachment questionnaire (AV and AX) were centered by transformation into z-scores in order to avoid multicollinearity problems. These z-scores were then used for all subsequent statistical analyses.

The first step of our statistical analysis was performed by computing a multivariate analysis of covariance (MANCOVA). To do so, we entered pleasantness, arousal, and subjective control scores as dependent variables, valence and social content of the stimuli as fixed factors, and AV and AX scores (plus their interaction term AVAX) as covariates. This allowed us to identify any overall main effects and interactions.

In a second step, we inspected the attachment style effects and interactions derived from the MANCOVAs by performing complementary multiple regression analyses. For the latter, we entered the rating scores as dependent variables for each experimental condition separately (i.e., pleasantness rating for SP images), and AV and AX scores as well as their interaction term (AVAX) as independent factors. This ensured that any reported associations between an experimental condition (rating score) and one attachment dimension remained significant when simultaneously controlling for potential effects of the other attachment dimension (as well as the interaction term AVAX).

The initial MANCOVA only revealed an influence of valence on all three rating scales [$F$s(1,51) > 62, $p$s < .001]. This was reflected by higher scores for positive versus negative scenes on the Pleasantness and Control dimensions, but higher scores for negative versus positive scenes on the Arousal dimension. Positive scenes were thus rated as significantly more pleasant and more controllable, whereas negative scenes were rated as more arousing. There was no influence of social content on rating scores [$F$s(1,51) < .95, $p$s > .33].

Critically, for *Pleasantness*, the MANCOVA showed an additional valence x AV interaction [$F(1,51) = 5.59$, $p < .05$], suggesting that pleasantness ratings were modulated by AV. This effect was further examined by means of multiple linear regressions, revealing a selective negative relation between AV scores and pleasantness ratings for SP scenes [beta = –.31, $p < .05$], with no such relation for other stimuli (Figure 1a). In other words, the higher participants scored on AV, the less positive they rated SP scenes.

In contrast, for *Arousal*, the MANCOVA showed a significant interaction of AX with arousal ratings in general [$F(1,51) = 15.84$, $p < .001$]. This was also further examined by multiple regressions, which revealed a positive association between AX and arousal judgments for both the SN [beta = .34, $p < .05$], and NSP [beta = .28, $p = .05$] scenes (Figure 1(b)), plus similar positive trends for NSN [beta = .27, $p = .066$] and SP [beta = .25, $p = .091$] images. Thus, the higher participants scored on AX, the more they felt aroused by emotional scenes in general, and with SN content in particular.

Finally, for the ratings of perceived *Control*, the MANCOVA showed a marginal valence x AX interaction [$F(1,51) = 3.54$, $p = .061$]. Again, multiple regressions were used to better define this effect, revealing a significant negative correlation between AX

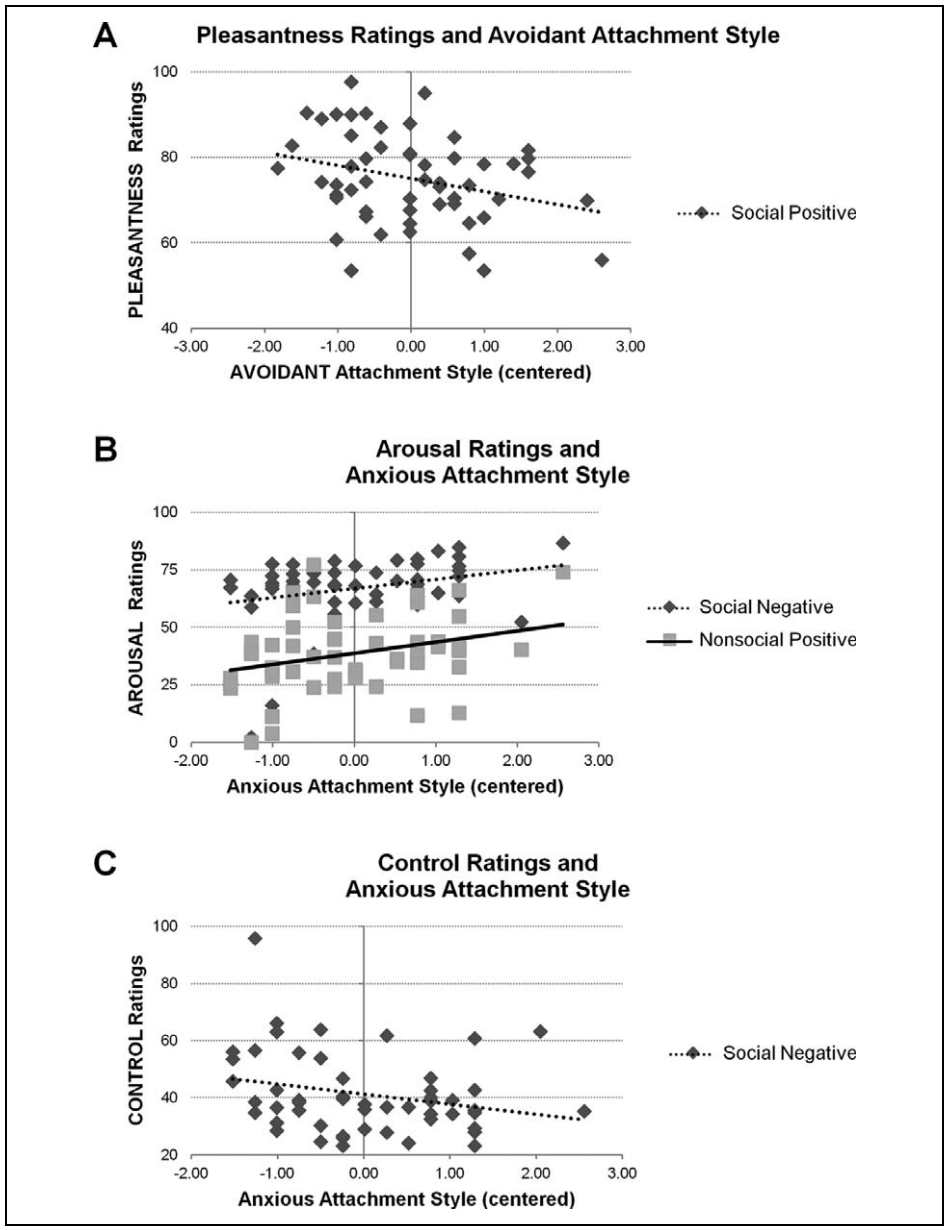


**Figure 1.** (a) Negative relation between Pleasantness ratings and avoidant attachment (AV), showing that the higher the AV score, the less pleasant Social Positive (SP) images were evaluated. Pleasantness ratings were not correlated with anxious attachment (AX). (b) Positive relation between Arousal ratings and AX, indicating that the higher the AX score, the more arousing Social Negative (SN) and Non-social Positive (NSP) images were evaluated (similar trends were observed for Non-social Negative (NSN) and SP scenes, see text). Arousal ratings were not correlated with AV. (c) Negative relation between Control ratings and AX, showing that the higher the AX score, the less controllable SN scenes were evaluated. Arousal ratings were not correlated with AV.

and control judgments for the SN scenes [beta = –.29, $p = .05$] but no correlation with other scene categories (Figure 1c).

## Discussion

This study asked the simple but fundamental question of whether adult attachment style has an influence on the conscious appraisal of emotional stimuli, even when these make no explicit reference to attachment-related concepts. For this purpose, participants were asked to rate social and non-social, positive and negative images on pleasantness, arousal, and control, requiring explicit judgments of emotional scenes along three classic dimensions of affect (Bradley & Lang, 1994). Our data revealed distinct effects of avoidance (AV) and anxiety (AX) on subjective emotional judgments, as we discuss below for each attachment style in turn.

### *Avoidant attachment style*

We found that AV had a specific effect on pleasantness ratings, particularly for positive and social images (SP). This was clearly reflected by results from our multiple regression analysis: the higher subjects scored on AV, the less pleasant they rated SP scenes. There were no other relations between this attachment dimension and any other stimulus category or any other aspects of emotional ratings (i.e., arousal and control).

These findings dovetail with previous research, indicating a relative absence of positive behaviors and experiences in avoidantly attached individuals in the context of social relationships (Cohen & Shaver, 2004). Moreover, individuals with an avoidant attachment style are known to report fewer positive emotions (Searle & Meara, 1999) and judge everyday social interactions as more boring and less engaging (Tidwell, Reis, & Shaver, 1996), as compared with securely attached individuals. In addition, avoidantly attached individuals were found to rate positive emotions induced by movie clips with attachment-related content as less arousing than participants with other attachment styles (secure, preoccupied, and fearful/avoidant; see Rognoni et al., 2008). These effects have previously been related to the deactivating strategies that avoidantly attached individuals employ to minimize the impact of positive emotions associated with social encounters and attachment needs (Mikulincer & Shaver, 2007). Here, we confirm these differences, but also extend previous results by uncovering two additional points of interest in the pattern of decreased positive emotional experience in avoidantly attached individuals.

Firstly, we show that changes in emotion experience associated with AV are specific to social contexts, but not limited to information with direct attachment-related meaning. Indeed, the reduction in perceived pleasantness was more pronounced for social scenes, which concerned representations of interpersonal situations (but no explicit attachment figures or scenarios), and there was no general effect on the appraisal of other positive stimuli. Secondly, the reduced pleasantness ratings for SP images did not entail an increase in the ratings of subjective control for this condition, as could have been expected from previous assumptions (Mikulincer & Shaver, 2007) and recent

neuroimaging data (Vrtička et al., 2012), according to which AV might primarily involve deactivation strategies and emotional suppression to cope with affectively close or warm social encounters. Instead, our results point to a direct effect of AV on the conscious appraisal of positive emotions in social scenes.

These findings converge with recent functional neuroimaging studies that reported a selective correlation between AV and neural activity in brain areas associated with emotional processing. In the first functional magnetic resonance imaging (fMRI) study (Vrtička et al., 2008) using a pseudo-interactive game paradigm in which feedback on performance was conveyed by pictures of smiling or angry faces from virtual partners, participants with higher AV were found to exhibit a weaker activation of reward circuits (ventral striatum and ventral tegmental areas) in response to the socially supportive faces (i.e., smiling to convey positive feedback). This modulation by AV was specific to the perceived social meaning of facial expressions in relation to current task goals, because no such effect was produced in ventral striatum by smiling faces presented in a different feedback context. This suggests a selective impassiveness of avoidantly attached individuals to rewards with social meaning (rather than to any type of reward). A very similar finding was observed by another fMRI investigation during which mothers saw images of their own versus unknown children (Strathearn et al., 2009), revealing decreased reward-related activity in avoidantly (as compared to securely) attached mothers. Furthermore, in another fMRI study (Suslow et al., 2009), AV was found to correlate with reduced activation of the primary somatosensory cortex to masked presentations of sad faces, possibly indicating a reduction in emotional contagion and recognition functions mediated by somatosensory cortices (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Pourtois et al., 2004).

Overall, our results for AV suggest that the defensive strategies aiming at keeping the attachment system in a deactivated state may lead to a selective decrease in the pleasantness of SP scenarios. Normally perceived as reinforcing and promoting interpersonal closeness, such information might be perceived as goal-incongruent by avoidantly attached individuals and thus evaluated as less desirable. Such a notion is corroborated by fMRI data from our group (Vrtička et al., 2008), showing that AV only decreased reward-related activity to SP feedback, but not positive game-performance feedback in general. In terms of attachment theory, these results therefore provide new support to the idea that AV might be associated with negative other-perception (Mikulincer & Shaver, 2007), even in positive social interaction situations.

### *Anxious attachment style*

In contrast to the above, our results revealed selective effects of AX on subjective ratings of arousal across several image conditions, but not on the ratings of pleasantness. Thus, the higher subjects scored on AX, the more arousing they judged emotional scenes in general, including in particular SN images. A similar correlation was observed between AX and arousal ratings for non-social and positive (NSP) images, but to a slightly weaker degree. In addition, there was a selective negative relation between AX and judgments of control for SN images (i.e., the higher our subjects scored on AX, the less controllable they rated SN images). Thus, only negative images with social scene content displayed

consistent relations with AX, for *both* arousal *and* control ratings, therefore suggesting a predominant effect of AX on the perception of social information with potential (but not direct) attachment relevance. These data agree with previous claims (Kurdek, 2002) that AX, as measured by the adult attachment questionnaire used here (RSQ; Griffin & Bartholomew, 1994; Guedeney et al., 2010), specifically probes the appraisal of threat for interpersonal relationships, but does not concern all aversive stimuli or anxiety in general. On the other hand, however, we found that higher AX scores were also associated with higher subjective arousal ratings for all positive (social and non-social) images, suggesting a broader impact of AX on arousal response to emotional scenes.

Our findings that AX entails increased subjective arousal and decreased control/coping judgments to SN images is highly consistent with the assumptions of adult attachment theory. Because anxiously attached people tend to adopt hyperactivating strategies, they display increased fears of rejection and abandonment, which makes them more vigilant and sensitive about signals of social threat, loss, or disapproval. Thereby, unlike the down-regulation of emotions observed in avoidantly attached individuals, anxiously attached people usually up-regulate, or intensify, their emotions (Mikulincer & Shaver, 2007). Several behavioral studies have confirmed this general pattern of increased arousal and decreased control to socially threatening stimuli in anxiously attached individuals. For instance, one study investigated the influence of attachment style on emotional distress elicited by relationship threat (Meyer, Olivier, & Roth, 2005), and asked female participants who were in a current romantic relationship to rate the degree to which they felt that different scenarios would be a threat to their relationship. These possible scenarios differed in degree of relationship threat and were based on an imaginative event that their partner had cancelled Saturday plans with them to instead spend all day and evening with another person, ostensibly to ''study for an exam''. Three pictures of the other person were shown – one was a man (low threat), the second a moderately attractive woman (medium threat), and the third a highly attractive woman (high threat). Results showed that AX was consistently linked to emotional distress, implying that females with anxious attachment were particularly sensitive to negative social scenarios. Another study reported increased arousal in anxiously attached subjects when viewing movie clips with negative relationship scenarios, inducing emotions of fear and sadness (Rognoni et al., 2008). More strikingly, a study examined the tolerance for experimentally induced pain (Meredith, Strong, & Feeney, 2006) and found that subjects scoring high on AX reported increased catastrophizing and stress, perceived less control, and exhibited weaker ability to decrease pain experience. The authors attributed these effects of high attachment anxiety to maladaptive coping cognitions and emotional distress.

In keeping with these behavioral findings, recent neuroimaging data indicate that higher AX scores correlate with enhanced responses of the amygdala to socially threatening cues, including words with rejection meaning (Lemche et al., 2006) and faces with angry expressions (Vrtička et al., 2008), as well as of the insula and anterior cingulate cortex to scenarios representing social rejection (Dewall et al., 2012). In the second study (Vrtička et al., 2008), amygdala activation was specifically related to the social value of angry expression, since it arose only when angry faces were presented as negative feedback from virtual partners, but not in a different feedback context.

Because the amygdala is known to be critically implicated in processing threatening and self-relevant affective information (Adolphs et al., 2005; Sander, Grafman, & Zalla, 2003), and has strong projections to autonomic and attentional systems (Vuilleumier, 2005), these imaging results support the notion that a key aspect of AX involves both high reactivity and hypervigilance towards socially significant cues, and provide a plausible neural substrate for increased arousal responses to socially and emotionally significant stimuli in our study.

Finally, in addition to SN images, both SP and NSP images were also rated as more intense by anxiously as compared to securely attached participants, suggesting a more general impact on all stimuli, even when pleasant. However, these data might be consistent with some hypothesis of adult attachment theory, stating that the primary cognitive-affective hallmark of anxiously attached people might be an ambivalence in emotion regulation strategies, leading to stronger positive *and* negative attitudes, and presumably reflecting a mixture of desire for security and sensitivity to rejection (Mikulincer & Shaver, 2003, 2007; Mikulincer, Shaver, Bar-On, & Ein-Dor, 2010). Unfortunately, only few studies have directly investigated ambivalence in relation to AX, but there is some evidence that anxiously attached students are more ambivalent toward their parents and romantic partners (Maio, Fincham, & Lycett, 2000). Our data indirectly extend this notion by showing that anxiously attached people rated all positive images as subjectively more arousing, irrespective of the scene content, which might reflect heightened vigilance *and* needs for reassuring. However, more research on AX and ambivalence is needed to further clarify this issue.

## Conclusion

Taken together, our data reveal that adult attachment style entails significant differences in the conscious appraisal of emotional scenes, with distinctive effects on dimensions of pleasantness, arousal, and control. On the one hand, the higher subjects scored on attachment avoidance, the less pleasant they perceived SP scenes. On the other hand, the higher subjects scored on attachment anxiety, the more arousing they evaluated emotional stimuli, particularly when negative *and* social, and the less controllable they perceived the latter type of scenes. Our data not only converge with classic notions about the influence of adult attachment style on behavior in interpersonal settings, but also extend these effects to more general emotional contexts not directly related to attachment figures. Further, these results add to recent neuroimaging findings showing modulations in brain areas critical for threat and reward processing, and demonstrate the specific emotional impact of attachment style in terms of valence and social content.

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