# The influence of psychological resilience on the relation between automatic stimulus evaluation and attentional breadth for surprised faces

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Abstract

The broaden-and-build theory relates positive emotions to resilience and cognitive broadening. The theory proposes that broadening effects underly the relation between positive emotions and resilience, suggesting that resilient people can benefit more from positive emotions at the level of cognitive functioning. Research has investigated the influence of positive emotions on attentional broadening, but the stimulus in the target of attention may also influence attentional breadth, depending on affective stimulus evaluation. Surprised faces are particularly interesting as they are valence ambiguous, therefore, we investigated the relation between affective evaluation –using an affective priming task- and attentional breadth for surprised faces, and how this relation is influenced by resilience. Results show that more positive evaluations are related to more attentional broadening at high levels of resilience, while this relation is reversed at low levels. This indicates that resilient individuals can benefit more from attending to positively evaluated stimuli at the level of attentional broadening.

*Keywords:* positive emotions, positively evaluated stimuli, attentional breadth, surprised faces

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A central theory on positive emotions, the broaden-and-build-theory (Fredrickson, 1998), proposes positive emotions to be related to resilience and to broadening of people's thought-action repertoires. The idea that positive emotions are related to resilience has been supported by research showing that the experience of positive emotions, especially among high-resilient people, facilitates stress recovery after a negative emotion induction (Tugade & Fredrickson, 2004) and in response to naturally occuring stressors (Ong, Bergeman, Bisconti, & Wallace, 2006). The broadening function of postive emotions has also received support from research associating positive emotions to increased creativity, social openness, and visuospatial attentional breadth (for review, see Garland et al., 2010). The effects on attentional broadening are not always consistent though (Bruyneel et al., 2012), and indicate that more research is necessary into possible conditional factors.

Importantly, the broaden-and-build theory states that the cognitive broadening effects of positive emotions underlie the relation between positive emotions and resilience (Fredrickson, 1998). This suggests that especially resilient people can benefit from positive emotions at the level of cognitive functioning. That is, if the cognitive broadening effects of positive emotions underlie (the development of) resilience, then especially those individuals who have actually developed more resilience would show stronger cognitive responses to positive emotions. Furthermore, research on mood disorders has in recent years shifted its focus to investigating not only negative emotion regulation but also positive emotion regulation. Even more studies are showing that mood disorders are related to a disrupted regulation of positive emotions with, for example, depression being associated with avoidance and down regulation of positive emotions (for review see Carl, Soskin, Kerns, & Barlow, 2013). It is possible that this disrupted regulation of positive emotions depending on levels of

depressive symptoms, reflecting lower levels of psychological resilience, extends to a dysregulation of effects of positive emotions on an information-processing level. Previous studies investigating the broadening effects of positive emotions have, however, not taken into account interindividual variability in (trait) characteristics and how this could influence the relationship between positive emotions and cognition, specifically attentional breadth. The broaden-and-build theory (Fredrickson, 1998) was developed from a resilience perspective and proposes attentional broadening effects of positive emotions to underlie resilience, suggesting that especially highly resilient people show attentional broadening in response to positive emotions. Therefore we aimed at testing the moderating influence of psychological (trait) resilience on the relation between positive emotion and attentional breadth, as it is possible that the strength of this relationship differs depending on levels of psychological resilience. To our knowledge, it has not previously been investigated whether interindividual variability in levels of psychological resilience influences the relationship between positive emotions and attentional breadth. That is, whether the effects of positive emotions on an attentional processing level are different (or disrupted) depending on levels of psychological resilience.

When investigating conditional factors affecting the attentional broadening effects of positive emotions, it does not only seem relevant to take into account interindividual variability of (trait) characteristics like psychological resilience, but also to investigate the influence of the presented, processed stimulus when measuring attentional breadth. While in most studies investigating the attentional broadening effects of positive emotions, mood was manipulated and then a non-emotional attentional breadth task was administrated, a previous study found that positive mood interacted with the valence of the presented stimulus by showing that positive mood broadened attention only for positive stimuli (Wadlinger & Isaacowitz, 2006). This suggests that the presented stimulus in itself – without additional

manipulation of mood - may also influence attentional breadth depending on its emotional valence. Following from the effect of positive emotions on attentional broadening, it may be that the processing of positively evaluated stimuli is related to attentional broadening when those stimuli are the target of attention. However, this direct effect of the presented stimuli on attentional breadth for those stimuli has not yet been tested.

The aim of the current study was to investigate how the processing of stimuli influences attentional breadth for these stimuli, depending on their affective valence and how this effect is influenced by resilience. Emotional stimuli that are particularly useful in investigating this effect are surprised faces, not because of the discrete emotion of surprise itself, but whereas most emotional expressions reveal information regarding the valence of their eliciting context, this remains ambiguous for surprised expressions. In other words, one can be either pleasantly or unpleasantly surprised, but a surprised expression itself does not immediately predict the valence of the eliciting event or outcome (Kim, Somerville, Johnstone, Alexander, & Whalen, 2003; Tomkins & McCarter, 1964). This implies that people can vary in how they perceive surprised faces, as having more negative or more positive valence. Research from a related domain (affective neuroscience) has shown that the neural activation pattern in response to viewing surprised faces, contrasted to neutral faces, was dependent on the emotional rating of these faces (Kim et al., 2003). Kim and colleagues (2003) found that more negatively rated surprised faces were related to greater right ventral amygdala activity, a subcortical region implied in the processing of negative emotions, whereas more positively evaluated faces were related to greater activity in the ventral medial prefrontal cortex, a region that has a regulatory input to the amygdala. These results indicate that variation in the affective evaluation of surprised faces as more positive or negative can influence the effects elicited by viewing them. This characteristic of surprised facial stimuli, their valence ambiguity, makes this stimulus category very useful when investigating whether

the processing of stimuli can directly influence attentional breadth, depending on their affective evaluation. Using variability in affective evaluation of one type of stimuli has a methodological advantage over, for example, comparing the attentional broadening effects of happy versus sad facial stimuli, because differences in basic visual characteristics of these two types of stimuli may also influence attention. Regarding the question of whether stimuli can directly influence attentional breadth depending on their valence, we hypothesized that evaluating surprise faces as more positive will evoke more attentional broadening when surprised facial expressions are presented, in line with the proposed broadening effects of positive emotions.

We examined the effects of the affective evaluation of (surprised) stimuli on attentional breadth using an affective priming paradigm, measuring affective evaluation in a more implicit manner. Attentional breadth was measured using a performance-based measure which has been used before to measure fluctuations in attentional breadth related to centrally presented stimuli (Bosmans, Braet, Koster, & De Raedt, 2009). We included a contrast category of neutral faces for methodological reasons as participants have to correctly identify the centrally presented stimulus (surprise versus neutral) in this task. Moreover, including neutral faces as an additional category in both tasks allowed us to investigate the specificity of the effect.

We hypothesized that the processing of surprised stimuli when evaluated as more positive, indicated by the affective priming paradigm, would be related to more attentional broadening when these faces are presented. Furthermore, we hypothesized that this relationship would be influenced by resilience, with high resilience scores being associated with a stronger relation between affective evaluation of stimuli and attentional narrowing/broadening when these stimuli are presented.

## Method

## Participants

Fifty-one undergraduates (45 females) aged between 18 and 34 years ($M$ = 22.37, $SD$ = 3.42) participated in this study and were paid for their participation. Participants were recruited through an experiment website where students can voluntarily sign up for participation in psychology experiments. The sample size was based on previous experience with the attentional breadth task and all data exclusions are reported. All measures used in the study are described, except for the BIS/BAS scales (Carver & White, 1994) which were used for explorative reasons not related to the hypotheses of this study. This experiment was approved by the local ethical committee of the Faculty of Psychology at Ghent University.

## Materials

**Questionnaire measures.** Both trait and state affect were measured with the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). Participants were asked to rate the degree to which they felt the emotions "*at this moment*" for the state version and "*in general*" for the trait version on a scale ranging from 1 "very slightly" to 5 "very much".

To assess the presence of depressive symptoms, we used the self-report Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996; Van der Does, 2002).

Trait anxiety was measured with the State and Trait Anxiety Inventory (STAI-trait; Spielberger, Gorsuch, Lushene, Vagge, & Jacobs, 1983; Van der Ploeg, Defares, & Spielberger, 2000). Participants are asked to rate how they feel "*in general*" on a 4-point scale ranging from "almost never" to "almost always".

Trait resilience was measured using the Dutch Resilience Scale (RS-nl; Portzky, 2008). This scale consists of 25 items asking participants to rate to what degree they agree or disagree with statements on a 4-point scale ranging from "totally disagree" to "totally agree". Two subscales can be calculated, Personal Competence and Acceptance of Self and Life. The

subscale Personal Competence consists of 17 items and represents self-confidence, independence, determination, resourcefulness, and self-reliance. The subscale Acceptance of Self and Life consists of 8 items and represents equanimity, adaptability, acceptance of life as it comes, and a balanced perspective of life (Portzky, 2008). The RS-nl has shown to have good internal consistency with a Cronbach's alpha of $\alpha = 0.85$, the subscale Personal Competence also showed good internal consistency, $\alpha = 0.81$, and the subscale Acceptance of Self and Life revealed acceptable internal consistency, $\alpha = 0.68$ (Portzky, Wagnild, De Bacquer, & Audenaert, 2010). Cronbach's alpha levels from the current study sample were comparable. The RS-nl showed good internal consistency, $\alpha = 0.85$, as did the subscale Personal Competence, $\alpha = 0.81$. The subscale Acceptance of Self and Life revealed acceptable internal consistency, $\alpha = 0.70$.

**Attentional breadth task.** Attentional breadth for surprised and neutral faces was measured using a paradigm based on a task developed by Bosmans et al. (2009). This task was adjusted to measure attentional narrowing/broadening in relation to surprised and neutral facial stimuli. In each trial, a picture of a face without hairline appeared in the center of the screen, see Figure 1. Sixteen surprised and 16 neutral faces were selected from the Karolinska Directed Emotional Faces database (Lundqvist, Flykt, Ohman, 1998), based on a valence and arousal rating obtained from prior validation (Goeleven, De Raedt, Leyman, Verschuere, 2008). An equal number of male and female faces was selected within each condition. Surprised and neutral faces were randomly presented, intermixed throughout the task. Simultaneously with presentation of the central picture, 16 gray dots with a 2 cm diameter appeared around the picture in two concentric circles (eight per circle). The closest circle appeared at 4.5 cm from the central face at 10° of the visual angle, the furthest circle appeared at 11.2 cm from the central face at 25° of the visual angle. The gray dots were arranged in pairs of two, one close and one far, situated on one of eight imperceptible axes.

Simultaneously with presentation of the picture and gray dots, a smaller, black circle with a diameter of 1.3 cm appeared in one of the gray dots, either close or far. This smaller circle was the target stimulus participants had to identify. After presentation of the stimuli, participants were first asked to identify the central stimulus (i.e. neutral or surprised) and second to identify the axis on which the target stimulus (i.e. the smaller black circle) had appeared. Participants used the mouse to click on the corresponding buttons on the screen.

The main dependent variable was the proportion of correctly localized target stimuli, on trials in which participants also correctly identified the central stimulus. This was to make sure participants maintained attention to the center of the screen during the task. From this we calculated an index of Attentional Narrowing (ANI = accuracy target stimulus close to face - accuracy target stimulus far from face) for both surprise trials (ANIsurprise) and neutral trials (ANIneutral). The more positive this score, the more attentional narrowing for the centrally presented stimuli. Because of our mere interest in early, automatic attentional processes, all stimuli were presented simultaneously for 68 msec in order to avoid confounds of saccadic eye movements in search of the peripheral target (Ball, Beard, Roenker, Miller, & Griggs, 1988). That is, the central and peripheral stimulus are shown at the same time for a short presentation time, to avoid individuals to perform a (serial) visual search for the peripheral target.

Figure 1 about here

**Affective priming.** An affective priming paradigm was used to infer participants' affective evaluations of surprised and neutral stimuli categories, as this paradigm has been widely studied and used in assessing people's (implicit) attitudes to and evaluations of certain categories of stimuli (for a review, see De Houwer, Teige-Mocigemba, Spruyt, & Moors,

2009). Affective priming is based on the idea that people are faster at evaluating a target stimulus if that target is preceded by a prime stimulus of similar valence, compared to when a target is preceded by a prime with a different valence.

Each trial in the task consisted of presentation of a fixation cross for 500msec, followed by a blank screen for 500msec. Subsequently, the prime was presented for 200msec, followed by a blank screen for 50msec before the target was presented until a response was given, or the target disappeared automatically after 2sec if no response was given. The time between trials varied randomly between 500, 1000, or 1500msec. All stimuli were presented in the center of the screen. Primes consisted of the 16 surprised and 16 neutral faces which were shown in the attentional breadth task (384 x 384 pixels), or 8 different filler-images of geometrical shapes on a light blue background (512 x 384 pixels). Targets were five positive (baby, teddy bear, dolphin, kitten, bride) and five negative (explosion, skulls, gun, worms, corpse) colour pictures (512 x 384 pixels) based on targets used by Spruyt, Hermans, De Houwer, and Eelen (2002, experiment 3). Participants were instructed that positive or negative pictures would be presented which are preceded by pictures of either surprised or neutral faces which they had seen before, or images of geometrical shapes. Participants were told that they should focus their attention on the second image as the task consisted of identifying the second image as positive or negative as fast as possible. People are expected to be faster in evaluating the target when it has been preceded by prime of similar valence. We calculated an affective prime score for the surprise (APTsurprise) and neutral (APTneutral) condition separately, for example: (surprise-negative – surprise-positive) - (filler-negative – filler-positive). This score reflects the difference in reaction time for identifying the target as negative compared to identifying the target as positive when these targets were preceded by a surprise face (the prime), corrected for the main effect of target valence (fillers). A more positive score indicates that the participant was faster at correctly identifying a target as

positive than correctly identifying a target as negative when the targets were preceded by a surprised face, suggesting that the participant evaluated the prime stimuli (i.e. the surprise stimuli) as more positive based on the idea of affective priming. That is, based on the idea that people are faster at evaluating a target stimulus if that target is preceded by a prime stimulus of similar valence.

**Procedure**

After informed consent, all participants filled out the PANAS state questionnaire, followed by the attentional breadth task. Participants were seated at a distance of 27 cm from a 19” CRT-computer screen, using a chin rest to ensure correct positioning. The task consisted of eight practice trials with a presentation time of 250 msec to allow participants to get acquainted with the task, followed by eight practice trials with a presentation time of 68 msec. The test phase consisted of 128 trials, with four types of trials: surprise-close, surprise-far, neutral-close and neutral-far which were randomly presented in two blocks consisting of 64 trials each. Following this, participants performed the affective priming task. The task consisted of 10 practice trials in which participants only had to identify the target pictures as positive or negative. Five positive and five negative pictures were randomly presented with the restriction that the same picture was never presented consecutively. This was followed by 12 practice trials in which the target was preceded by the prime, similar as in the test phase. The test phase consisted of 144 trials, with six types of trials: surprise-positive, surprise-negative, neutral-positive, neutral-negative, filler-positive and filler-negative which were randomly presented in two blocks of 72 trials each. Within each type of trial, the prime was randomly selected from the list of surprise, neutral, or filler images with the restriction that each image from the list was presented at least once and that the same picture was never presented consecutively. After the test phase participants were also asked to rate three neutral and three surprised faces randomly drawn from the list. Ratings were made on a 9-point

Likert scale ranging from 1 “negative” to 5 “neutral” to 9 “positive”. Finally, participants were asked to fill out the other questionnaires.

## Results

### Participant Characteristics

Means and standard deviations for all variables are presented in table 1.

Table 1 about here

### Stimulus Evaluation And Attentional Breadth

**Preliminary analyses.** To ensure that participants focused on the center of the screen during the attentional breadth task we deleted all trials in which the central face was incorrectly identified. This resulted in deleting an average of 4.09% of the trials. When calculating the reaction times in the affective priming paradigm, only correct trials were taken into account, and for each type of trial separately (i.e. surprise-pos, surprise-neg, neutral-pos, neutral-neg, filler-pos, filler-neg) reaction times that fell 2.5*SD*s below or above a persons’ mean reaction time were discarded. The percentage of deleted trials for all different trial types ranged between 5.72-6.86% and no differences in accuracy were found between conditions, nonparametric Wilcoxon Signed Ranks tests all *p*s > .10.

We explored whether state and trait affectivity, depressive symptoms, trait anxiety, and trait resilience had an influence on emotional evaluation and attentional breadth. Although the literature is mixed, negative affect and depressive symptoms have been related to a more local attentional scope (Basso, Schefft, Ris, & Dember, 1996). If these variables would have an influence on attentional breadth, this should be taken into account as this could obscure the relation between attentional breadth and the emotional evaluation of the facial stimuli. However, a priori exploration of the data revealed no significant correlations between

the questionnaire measures and the ANI, all *p*s > .05[1]. For the APT scores, only PANAS negative trait affectivity and STAI trait anxiety were negatively related to the affective priming score for neutral faces, $r = -.28$, $p = .045$ and $r = -.32$, $p = .024$ respectively. RS-nl total trait resilience was positively related to the affective priming score for neutral faces, $r = .29$, $p = .036$. This indicates that people who report to generally experience more negative affect and anxiety automatically evaluate neutral faces as more negative, while more resilient people evaluate neutral faces as more positive.

Affective priming scores for surprised and neutral faces were significantly correlated, $r = .51$, $p < .001$, indicating that people who perceive surprised faces as more positive also show this for neutral faces. Furthermore, there was also a significant correlation between the attentional narrowing index for surprised and neutral faces, $r = .70$, $p < .001$, indicating that relative attentional narrowing/broadening shows a similar pattern for surprise and neutral faces. A paired t-test showed that there is no significant difference between affective priming scores for surprised faces ($M = -1.07$, $SD = 31.69$) and neutral faces ($M = 3.05$, $SD = 27.46$), $t(50) = 0.99$, $p = .325$. The ANI index of attentional narrowing for surprised faces ($M = 0.47$, $SD = 0.14$) and neutral faces ($M = 0.48$, $SD = 0.15$) did not significantly differ either, $t(50) = 0.32$, $p = .753$. The APT scores for surprised faces ranged from -75.48msec to 95.83msec, and for neutral faces from -56.56msec to 63.75msec. The average APT score for surprised faces did not differ from zero, $t(50) = 0.24$, $p = .811$, nor for neutral faces, $t(50) = 0.79$, $p = .431$. This indicates that both categories of faces were averagely evaluated as neutral, but the range of scores and standard deviations indicate there was variance between participants in whether they rated surprised and neutral faces as more negative or more positive.

**Stimulus evaluation and attentional breadth.** Relations between automatic stimulus evaluation and attentional narrowing indices were investigated for surprised and neutral

[1] BDI and STAI-trait scores were square root transformed. For the RS-nl acceptance subscale, PANASstate positive and negative, and PANAStrait positive and negative, nonparametric Spearman correlations were calculated.

stimuli separately. There was no significant correlation between the affective priming score and the attentional narrowing index for Surprise trials, $r$ = -.11, $p$ = .440, nor for Neutral trials, $r$ = .10, $p$ = .490. We also investigated the relation between the explicit ratings and the attentional narrowing index, but no significant correlation was found for Surprise trials, $r$ = -.004, $p$ = .977, nor for Neutral trials, $r$ = -.01, $p$ = .954.

**Moderation effects of trait resilience.** We further investigated moderation effects of trait resilience on the relation between stimulus evaluation and attentional breadth. A hierarchical multiple regression analysis was performed to test moderation effects, following the approach of Aiken and West (1991). The APT scores and RS-nl scores were centered and the interaction was calculated by multiplying the centered APT and RS-nl scores. In the regression analysis on the ANI score, the centered variables were entered as predictors in a first step and the interaction term in the second step of the analysis. Results from this analysis revealed that the RS-nl did not significantly moderate the relation between the APT score and ANI score for neutral faces. The RS-nl total score near significantly moderated the relation between the APT score and the ANI score for surprised faces, $t$ = -1.84, $p$ = .071, observed power .44; however, the specific subscale Personal Competence significantly moderated this relation, $t$ = -3.22, $p$ = .002, observed power .88, and added an explained variance to the model of $\Delta R^2$ = .18[2].

To better understand this moderation effect, we estimated and plotted different conditional effects of the focal predictor on the outcome variable at low (one SD below the mean), moderate (sample mean), and high (one SD above the mean) values of the moderator, using Hayes and Matthes' SPSS macro (2009), see Figure 2. Results show a positive relation

[2] Results are reported for the moderation analysis after exclusion of 2 cases that strongly influence the model as indicated by scores above 1 on the DfFIT fitting index. As both APT and ANI scores for surprised and neutral stimuli were correlated, we performed additional analyses to investigate the specificity of the moderation effect. However, resilience did not moderate the relation between APTsurprise and ANI for neutral faces, nor vice versa, all interaction terms *p*s > .10.

between the APT score and ANI score for surprised faces at low levels (below 1 SD) of personal competence, $t = 2.26$, $p = .029$, $b = .003$, while a negative relation was found at high levels (above 1 SD) of personal competence, $t = -2.63$, $p = .012$, $b = -.003$. Such relation was nonsignificant at a moderate level (mean) of personal competence, $t = -0.08$, $p = .940$, $b < .001$. This indicates that more positive automatic evaluation of surprised faces was related to more attentional broadening for surprised faces among high levels of personal competence, in line with the broaden-and-build theory. However, among low levels of personal competence this relation was reversed with more positive evaluation of surprised faces being related to more attentional narrowing for surprised faces..

Trait resilience did not moderate the relation between the explicit rating of surprised faces and attentional breadth for surprised faces. Resilience moderated the relation between the explicit rating and attentional breadth for neutral faces, $t = 2.06$, $p = .045$. However, simple slope analyses revealed no significant relation between the explicit ratings and attentional breadth at any level of the moderator.

Figure 2 about here

## Discussion

This study aimed at investigating the effect of the emotional evaluation of surprised faces on attentional breadth for this category of stimuli and whether this effect is influenced by psychological resilience. We hypothesized that a more positive evaluation of surprised faces would be related to attentional broadening when surprised faces are the target of attention, but that this relation would be especially apparent among highly resilient people.

First, there was no correlation between attentional breadth or affective stimulus evaluation for surprised faces and resilience as such. Moreover, based on the first analyses in

this study, no direct relation was found between the automatic affective evaluation and attentional breadth for surprised faces. However, this relation was moderated by resilience, specifically feelings of personal competence. As predicted, we found that a more positive evaluation of surprised faces was related to more attentional broadening when surprise stimuli were presented, among high levels of personal competence. However, this relation was absent with average levels of personal competence and even reversed among low levels, with a positive evaluation being related to attentional narrowing. These results show it is not the processing of surprise stimuli itself that is related to attentional broadening per se, but the effect of surprise stimuli on attentional breadth, relative narrowing or broadening, was depending on the interaction between levels of resilience and how the valence of surprise stimuli was perceived. The results among high levels of personal competence are in line with the broaden-and-build theory (Fredrickson, 1998) and show that not only being in a positive mood can influence attentional breadth, but that the processing of positively evaluated emotional stimuli itself is also related to more attentional broadening. However, this relation was reversed among low levels of personal competence. Although we did not necessarily expect a reversed relation, this result could be viewed in light of recent research proposing a more complex link between affect and attentional breadth (Huntsinger, 2013). Affect is proposed to provide information on the attentional orientation that is most dominant at that moment, suggesting that negative affect acts as a "stop signal" while positive affect acts as a "go signal" for use of the momentarily dominant mode of processing (Huntsinger, 2013). Although there is no immediate evidence suggesting that for highly resilient people attentional broadening is the more dominant attentional orientation, this would be in line with the broaden-and-build theory (Fredrickson, 1998) proposing that attentional broadening by positive emotions underlies the building of personal resources and resilience. On the other hand, vulnerability factors like depressive symptoms or trait rumination, which reflect lower

levels of resilience, have been linked to a more local or narrow attentional orientation (Basso et al., 1996; Whitmer & Gotlib, 2013). Therefore, a tentative explanation for the reversed relation at high and low levels of resilience might be that processing of more positively evaluated emotional stimuli encouraged the continuation of the more dominant attentional orientation mode (and more negatively evaluated stimuli being more related to the lesser dominant attentional orientation mode given the nature of the linear relation). However, more research would be necessary to test this.

Although there was a correlation for both attentional breadth and affective priming between neutral and surprise faces, we found the moderated relation between stimulus evaluation and attentional breadth specifically for surprised stimuli but not for neutral stimuli. This may be due to the specific characteristic of surprised expressions, which is an emotional expression but as there is uncertainty about the valence of the elicited context or outcome it can be perceived as having positive or negative valence. Among high resilience levels, more attentional broadening in response to surprised faces was shown when these were evaluated more positively, in line with the idea of the broaden-and-build theory that positive emotions broaden attention. This attentional broadening may reflect some kind of exploratory behavior in case the stimuli are seen as more positive or ‘safe’, while more negative evaluations were related to more attentional narrowing. The broaden-and-build theory (Fredrickson, 1998) ascribes an important role to the broadening effects of positive emotions in the relation between positive emotions and resilience. It proposes that resilient people can use positive emotions to undo the effects of stress responses and over time build personal resources by experiencing positive emotions, through the broadening effects of positive emotions. Interestingly, this suggests that it is resilient people that can benefit from the experience of positive emotions at a cognitive level. Indeed, we found the relation between evaluation of surprised faces and attentional breadth in the presence of surprised faces, specifically amongst

high levels of personal competence. The subscale Personal Competence represents characteristics as self-confidence, independence, determination, resourcefulness, and self-reliance. These are individuals who believe in their own strengths and competences to cope with difficult situations, which may guide future behavior in dealing with issues, that seem to 'cognitively respond' by attentional narrowing/broadening to the emotional information presented at hand, depending on how this information is evaluated. The Acceptance of Self and Life subscale was not related to attentional broadening, although this may be caused by the lower reliability of this subscale.

A possible limitation to this study is the fact that we measured psychological resilience with a self-report questionnaire assessing how people generally behave or think, instead of assessing resilience following a stressor. However, self-reported resilience, has shown to account for variation in the emotional response to daily stressors (Ong et al., 2006). For future studies it may be interesting to measure stress reactivity and see how this influences the relation between positive emotions or evaluation of stimuli and attentional breadth.

Secondly, the effect we found could be explained by the fact that viewing surprised faces (even though interleaved with neutral faces) influences general mood when evaluated as more positive or negative, which then would cause the effect on attentional breadth. However, this seems unlikely as we would then expect a more general effect on attentional breadth for both surprised and neutral stimuli, which was not the case. We specifically found a moderated relation between the evaluation of surprised faces and attentional breadth when surprised faces were presented, suggesting that fluctuations in attentional breadth were related to the value of the target of attention.

In summary, we found that the affective evaluation of stimuli can influence attentional breadth when presented with those stimuli. Specifically among high levels of personal competence, there is a relation between more positively evaluating surprised faces and more

attentional broadening when surprised faces are presented, while this relation was reversed among low levels of personal competence. This suggests that specifically highly resilient people seem to be able to benefit – in the form of attentional broadening - from attending to information that they automatically evaluate as more positive.

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Table 1

*Participant characteristics*

| | M (SD) |
|---|---|
| Age | 22.37 (3.42) |
| PANAS state Positive | 32.18 (5) |
| PANAS state Negative | 12.76 (3.94) |
| PANAS trait Positive | 35.25 (4.88) |
| PANAS trait Negative | 16.76 (4.98) |
| BDI-II | 6.55 (6.35) |
| RS total | 78.88 (8.23) |
| RS personal competence | 54.96 (5.78) |
| RS acceptance | 23.92 (3.43) |
| STAI-trait | 37.75 (9.30) |

## Figure Captions

*Figure 1.* Stimulus presentation of the Attentional Breadth Task. The gray dots are presented in pairs of two, simultaneously with the central face and the peripheral target stimulus. The first response screen asks participants which face they have seen. The second response screen asks participants on which of eight axes the target stimulus was presented.

*Figure 2.* The regression lines derived from estimating the different conditional effects of the APT score (i.e. stimulus evaluation) for surprised faces on the ANI index (i.e. attentional narrowing index) for surprised faces at low, average, and high values of Personal Competence. This plot was derived using Hayes and Matthes' SPSS macro (2009).

*Figure 1.*

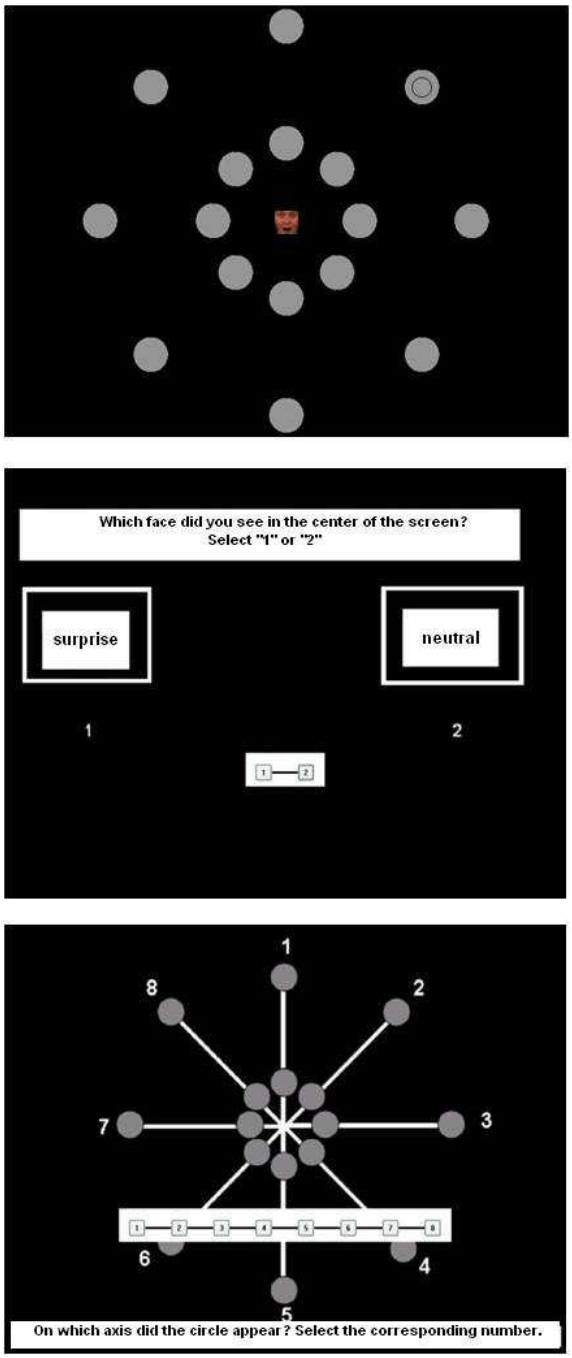
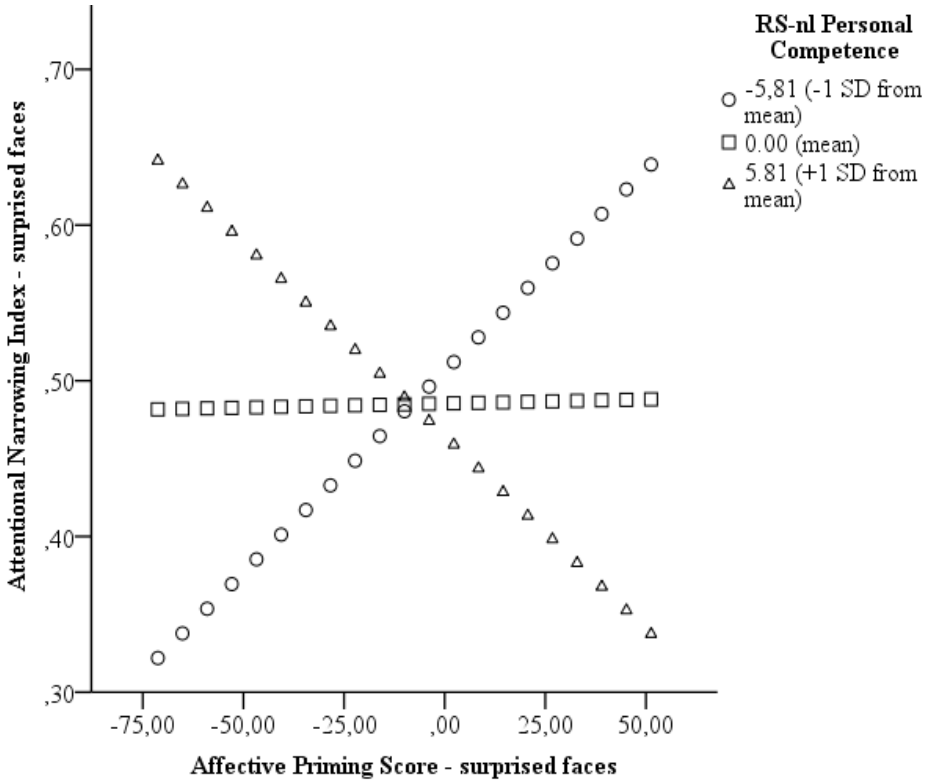

Which face did you see in the center of the screen?
Select "1" or "2"
surprise
neutral
1
2
1
2
3
4
5
6
7
8
On which axis did the circle appear? Select the corresponding number.

*Figure 2.*


RS-nl Personal Competence
-5,81 (-1 SD from mean)
0.00 (mean)
5.81 (+1 SD from mean)
Attentional Narrowing Index - surprised faces
,70
,60
,50
,40
,30
-75,00
-50,00
-25,00
,00
25,00
50,00
Affective Priming Score - surprised faces