Summer 2016

The Influence of Happy Faces on Spatiotemporal Vision

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THE INFLUENCE OF HAPPY FACES ON SPATIOTEMPORAL VISION

A Thesis
Presented to
The Faculty of the Department of Psychology
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
Of the Requirements for the Degree
Master of Arts

By
Siera Bramschreiber

August 2016

THE INFLUENCE OF HAPPY FACES ON SPATIOTEMPORAL VISION

Date Recommended June 24, 2016

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I dedicate this thesis to my husband, Nolan, who supported me as I worked at my own pace on this project.

ACKNOWLEDGEMENTS

I am eternally grateful for the guidance and support of Dr. Andrew Mienaltowski throughout this journey. I would also like to thank Dr. Rick Grieve and Dr. Amy Brausch for their support, encouragement, and time as members of my thesis committee. I respect each of you and am thankful for the privilege of working with and learning from each of you. I would also like to thank Brandon Coffey, a fellow colleague who aided in the creation of E-prime files for the experimental trials. I must also recognize my fellow peers in the Lifespan Social Cognition Lab. Thank you for your time, conversations, and friendship. Best of luck to each of you.

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Past research demonstrates that fearful faces lead to an increase in temporal and a decrease in spatial gap detection, an effect proposed to be caused by a flow of input to the magnocellular pathways from the amygdala to the visual system (Bocanegra & Zeelenberg, 2009). The amygdala is also active for positive and arousing stimuli, including happy faces. The current study extends past research by presenting happy facial cues just before a gap detection task. Facial stimuli (i.e., happy/neutral faces) were presented in the periphery of the receptive field and quickly followed by a Landolt circle. Half of the participants were asked to detect a temporal gap and half a spatial gap. Response accuracy of gap detection was measured using signal detection theory. Consistent with past research on fearful faces, positive expressions were expected to facilitate temporal gap detection but not spatial gap detection when happy faces were used as cues in gap detection tasks. The current study found no difference in spatial or temporal gap detection given the emotional cue that preceded gap detection on each trial. Positive emotion did not appear to have the same impact as fear on the amygdala and visual areas involving attention.

Introduction

Emotional stimuli influence our behaviors and social interactions. Such stimuli act as social cues that dictate which social response is most appropriate and, in some cases, life-sustaining. Emotional facial stimuli reflect an internal emotional state, as well as have implications for what is going on in the surrounding environment. The observer must interpret the relevance of the emotional stimuli as these stimuli relate to his/her current position. From an evolutionary perspective, stimuli that reflect a threat activate threat-specific regions of the brain, mobilizing the body's resources to protect itself. The amygdala, a small almond-shaped structure in the limbic system, particularly responds to stimuli of biological relevance, including threatening and rewarding stimuli. Arousing and rewarding stimuli also have implications for survival involving procreation, positive and productive interaction, and attraction to food (Pessoa, 2013). Fredrickson (2001, 2004), creator of broaden and build theory, posits that positive emotion has even larger value to those who experience it, including a broadened thought-action repertoire and enhanced physical and intellectual resources. Although past research has highlighted the role of the amygdala in detecting threat, much less is known about its significance in processing positive emotional stimuli. That said, recent work has focused on the dynamic responses evoked in and by the amygdala when individuals are presented with emotionally positive stimuli.

Amygdala Reactivity to Negative Emotional Stimuli

Previous research overwhelmingly highlights the amygdala's role in communicating the emergence of emotional contexts in one's environment, particularly those stimuli that invoke threat. Researchers understand the functions of the amygdala by presenting emotional cues, such as emotional faces or scenes, while simultaneously measuring brain activity. Such studies reveal that the amygdala is active when presented with threatening stimuli, either in the form of facial cues or scenes (Blair, Morris, Frith, Perrett, & Dolan, 1999; Hariri, Tessistore, Mattay, Fera, & Weinberger, 2002). Interestingly, whereas arousing negative scenes activate the left amygdala, threatening faces activate the right amygdala (Hariri et al., 2002). The amygdala is also active when facial stimuli depict other negative emotions like disgust, sadness, and anger (Blair et al., 1999; Hariri et al., 2002; Fischer et al., 2005).

Damage to this subcortical brain region results in deficits in identifying emotions, particularly fearful facial expressions (Adolphs & Tranel, 2003; Morris et al., 1998). However, lesions in the amygdala may not impair one's ability to recognize or identify other emotional but non-threatening stimuli, like happy or angry faces in particular (Blair et al., 1999; Cardinal, Parkinson, Hall, & Everitt, 2002; Morris, Ohman, & Dolan, 1998; Vuilleumier, Richardson, Armony, Driver, & Dolan, 2004). Although damage to the amygdala impairs its typical role in detecting emotion, inflammation in this same structure enhances one's ability to identify threatening stimuli (Inagaki, Muscatell, Irwin, Cole, & Eisenberger, 2012). Overall, the amygdala plays an important role in enhancing the salience of self-relevant emotional stimuli, facilitating detection which in turn can speed along responses to these stimuli.

Amygdala Reactivity to Positive Emotional Stimuli

The impact of emotion on the amygdala, however, goes beyond the observer's efforts to protect his/herself or to thrive. Neuroimaging studies have also revealed that the amygdala is active in the presence of positive stimuli as well. Hamann, Ely, Hoffman, and Kilts (2002) presented pleasant stimuli (i.e., sexually arousing stimuli and appetizing food), aversive stimuli (i.e., depictions of mutilated bodies), neutral images (i.e., chess players and household scenes), and high interest images (i.e., unusual pictures that were memorable, yet not emotionally arousing) to participants. Heart rate and skin conductance increased in the presence of pleasant, aversive, and high-interest pictures. More importantly, amygdala activation was observed for both negative and positive emotional stimuli. Positive emotion activated the left amygdala and negative emotion activated the amygdala bilaterally (Hamann et al., 2002). Similar findings were noted when individuals were presented with positive emotional cues, including happy faces (Hamann & Mao, 2002; Liberzon, Phan, Decker, & Taylor, 2003; Zald, 2003). However, findings are mixed as to whether amygdala activation occurs in the presence of positive emotional stimuli, as other studies fail to note amygdala activation in response to positive stimuli.

Despite the uncertainty in the literature, activations of the dorsal and ventral striatum and ventromedial prefrontal cortex, which both receive projections from the amygdala, have been consistently observed when individuals were presented with positive emotional stimuli (Hamann & Mao, 2002; Todd, Evans, Morris, Lewis, & Taylor, 2011). These regions play a vital role in motivated behavior when responding to stimuli in one’s environment. Aside from the connectivity between the amygdala and frontal cortical and sub-cortical regions, how does emotional input facilitate stimulus perception in service to motivated responding? This question will be addressed next given its importance to the current study.

Understanding Amygdala-driven Systematic Facilitation of Stimulus Processing

Once the amygdala is activated by emotional stimuli, it then distributes input to sensory brain regions to enhance stimulus perception. For instance, Liberzon and colleagues (2003) found that positive and aversive emotional stimuli both enhanced activation of visual cortical regions. In other words, emotional stimuli impact one's ability to attend to subsequent stimuli in the environment and affect what is perceived. Sometimes this enhancement boosts the allocation of attention to specific regions of space (e.g., an exogenous cue), but other times it boosts one's perception of an unrelated, but subsequently appearing stimulus. Phelps, Ling, and Carrasco (2006) found that the presence of fearful faces in the periphery increases one's sensitivity to contrast, improving performance on a contrast sensitivity task in which participants detect the orientation of sinusoidal gratings in a visual stimulus.

It has been proposed that the amygdala receives visual input from the magnocellular pathway which then projects this input to various segments of the visual system, receiving reciprocal modulation itself from these very same regions (Bocanegra & Zeelenberg, 2009). Historically, the magnocellular pathway has been found to benefit the detection of depth and movement. The parvocellular pathway, which is parallel to the magnocellular pathway, benefits the detection of color and fine-grained details (Bocanegra & Zeelenberg, 2009; De Valois, Cottaris, Mahon, Elfar, & Wilson, 2000). These two pathways support peripheral and foveal vision, respectively.

Bocanegra and Zeelenberg (2009, 2011a, 2011b) demonstrated that a trade-off occurs between the two pathways as stimuli compete for visual processing resources. This trade-off impacts subsequent attention and behavioral responses. The researchers presented emotional stimuli to participants prior to temporal and spatial gap detection trials within tasks geared toward examining the impact of emotional cues on subsequent gap detection. When presented with fearful facial stimuli prior to gap detection, individuals detected temporal gaps (i.e., a flicker, or rapid onset-offset-onset of a stimulus) more accurately than they detected spatial (i.e., segment removed from a stimulus) gaps (Bocanegra & Zeelenberg, 2011a). As in the aforementioned work by Phelps and colleagues (2006), the fearful emotional expressions enhanced the detection of a subsequent stimulus, in this case the temporal-based flicker in the participants' peripheral vision. In addition to communicating with the visual system, the amygdala also projects to the orbitofrontal cortex, anterior cingulate, and nucleus basalis. These structures are all involved in controlling behavioral responses and utilize input from sensory systems. Morris et al. (1998) suggest that the amygdala is the link between sensory processing and response coordination for emerging responses to emotional stimuli.

What does this mean for positive emotion? Presumably, if the amygdala is active in response to the presence of positive emotion, the amygdala should have received some visual input from the magnocellular pathways and then communicated this information in a reciprocating manner to segments of the visual system responsible for processing magnocellular-related inputs, or regions that are particularly involved in judgments of motion or spatial location. If inputs to the magnocellular pathway that pass through the amygdala benefit the detection of movement and depth when negative emotional expressions are presented, individuals presented with positive emotional expressions should display similar gap detection performance gains when asked to judge the presence or absence of the timing-based gaps used in tasks created by Bocanegra and Zeelenberg (2011a). That is, participants should demonstrate an enhanced gap detection ability for temporal stimulus gaps (i.e., rapid onset-offset-onset flicker) and an impaired gap detection ability for spatial gaps (i.e., physical segment of stimulus absent), suggesting that amygdala-driven input enhances the functioning of the magnocellular pathway of the visual system while impairing the functioning of the parvocellular pathway.

Current Study

The current study proposed to recreate Bocanegra and Zeelenberg's (2011a) temporal and spatial gap detection tasks, substituting fearful facial expressions with positive ones. Based upon Bocanegra and Zeelenberg's (2011a) findings and what is known about the amygdalar activation in response to positive emotion, the current study sought to determine if positive emotional faces have similar effects on early visual processes as do fearful emotional faces. Positive expressions were expected to facilitate temporal gap detection but not spatial gap detection when happy faces were used as cues in gap detection tasks adapted from Bocanegra and Zeleenberg (2011a). If the happy facial expressions that appeared on the display prior to a target stimulus containing a temporal or spatial gap had an impact on gap detection performance, the nature of the impact would speak to the underlying system used to perceive the happy expression. More specifically, if the happy facial cues facilitate the detection of the temporal gap but inhibited the detection of the spatial gap, one could argue the positive emotional information travels along the magnocellular visual pathways in a manner similar to negative emotional information to boost the visual perception of a peripheral temporal gap stimulus.

Method

A 2 (emotional cue: happy vs. neutral) x 2 (task type: temporal task vs. spatial task) x 3 (task difficulty: small vs. medium vs. large gap sizes) mixed model design was used to examine if the presentation of happy cues affected one's ability to detect either a physical or timing-based gap in a circle stimulus.

Participants

Students were recruited from Western Kentucky University (WKU) to participate in the current study. There were 37 participants (17 male, 20 female) ranging in age from 18 to 39 years (M = 21.2, SD = 5.2). Students volunteered through a university online experiment scheduling system (i.e., WKU Study Board) that students use to meet course research requirements. Students were compensated with a study board credit for each 15 minutes of participation, giving them a total of six study credits upon completion of the study. All participants had normal or corrected-to-normal vision based upon a visual acuity screening conducted at the beginning of the experimental session. All subjects were provided with an informed consent document and informed about the nature of the study ("how people detect physical or timing gaps in stimuli") prior to their participation. Students could withdraw from the study at any time and for any reason, but no one did.

Materials

Gap Judgment and Emotion Perception Tasks. Participants sat approximately 57.3 cm from the screen (i.e., 1 cm of display subtended 1 degree of visual angle) and were instructed to keep their eyes on the fixation point at all times during the duration of the experiment. The instructions appeared on the screen prior to all judgment tasks. Experimenters read detailed instructions to participants to ensure that they understood each task. Each participant completed either the spatial gap detection judgment task (n = 18) or the temporal gap detection judgment task (n = 19), counterbalancing across gender. The design of the gap detection tasks was adapted from Bocanegra and Zeelenberg (2011a). In the trials for each task, a fixation cross appeared on the display for 30 ms, and was followed by a face pair cue for 70 ms, which was then followed by either a spatial gap stimulus or a temporal gap stimulus depending on the task. The face pair cues consisted of identical faces, 5.2˚ in diameter, and were presented at 8˚ to the left and right of fixation. Photographs of neutral and happy expressions of 10 different Caucasian adults (5 male and 5 female) from the NimStim Face Stimulus set were selected for use as emotional cues (Tottenham et al., 2009). The target, a Landolt circle with a diameter of .8˚, was presented 4˚ from the left or right of the fixation point. All stimuli were used in both of the gap detection tasks, which were presented on a 24-inch ASUS VG248 HD LCD monitor with a 144-hertz refresh rate.

Spatial Gap Detection Task. Participants assigned to the Spatial Gap Detection Task condition completed practice trials (depicted in *Figure 1*) prior to completing experimental trials (depicted in *Figure 2*). The practice spatial gap detection task consisted of 52 trials, half of which contained gaps (8 arcmin) and half which did not contain gaps. Practice trials did not include emotional cues. Participants were asked to focus on a fixation point presented on the screen for 30 ms and then respond to the presence or absence of a gap found in a Landolt circle that appears for 100 ms on the left or the right side of the display. Participants were given a 1200 ms time window to respond before the next practice trial began. Feedback about response accuracy (i.e., “Correct” or “Incorrect”) was presented on the screen for 500 ms following a response. If the practice trials were not completed satisfactorily, the participant had the option of completing the practice trials again until he/she felt comfortable with the task.

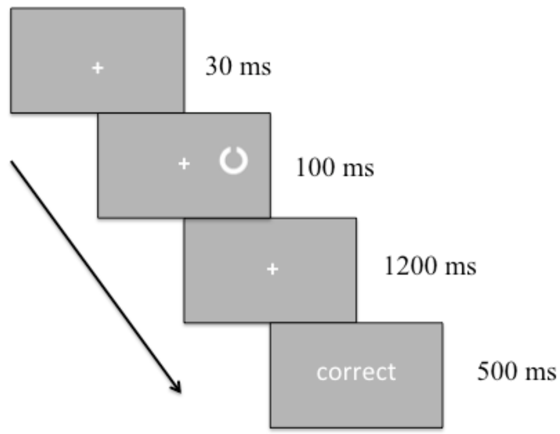

Figure 1. Spatial Gap Detection Practice Trial. This sample shows the progression of the practice trials for the spatial task from start to finish.

Following the practice trials, participants completed 240 experiment trials. Half of the trials presented happy faces as emotional cues to the left and right of the fixation point, and half presented neutral faces. Face cues appeared for 70 ms after a 1000 ms fixation period, and were followed by a subsequent 30 ms fixation period. Next, in half of the experimental trials, a Landolt circle containing a gap that varied in size (4, 6, or 8 arcmin; 40 trials for each gap size) was presented for 100 ms on the left or right side of the display. In the other half of the trials, a Landolt circle with no gap was presented for 100 ms on the left or right side of the display. The target was equally likely to appear on either side. Participants were given 1200 ms to indicate if they perceived a gap or not, and their responses were followed with a display that gave accuracy feedback (i.e., "Correct" or "Incorrect") for 500 ms. To reduce the impact of fatigue and visual strain, the program prompted participants to take a small break after every 60 trials, dividing the experimental trials into four blocks. Participants' responses were coded for hits, misses, correct rejections, and false alarms, which were then used to calculate gap discriminability (d') scores for each emotional cues type (positive versus neutral) and gap size (4, 6, and 8 arcmin).

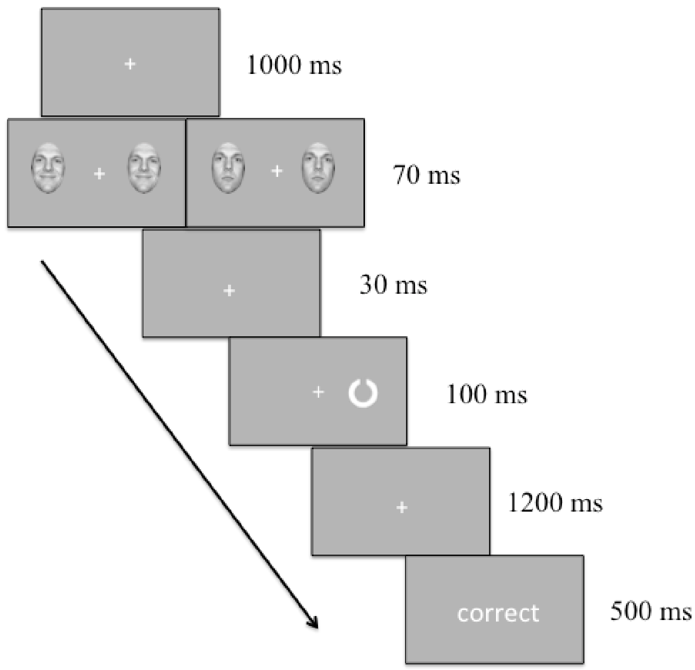

Figure 2. Spatial Gap Detection Experimental Trial. This sample shows the progression of the experimental trials for the spatial task from start to finish.

Temporal Gap Detection Task. Participants assigned to the Temporal Gap Detection Task condition also completed practice trials (depicted in *Figure 3*) prior to completing experimental trials (depicted in *Figure 4*). The practice task consisted of 52 trials, half of which contained gaps and half which did not contain gaps. Again, practice trials did not include emotional cues. Participants were asked to focus on a fixation point presented on the screen for 30 ms and then respond to the presence or absence of a gap that appears in a Landolt circle that appeared afterwards on the left or right side of the display. On trials with a timing gap, the Landolt circle appeared for 40 ms, disappeared for 24 ms, and reappeared for 40 ms. Participants were given a 1200 ms time window to indicate if they detected the temporal gap (or flicker) in the Landolt circle before the next practice trial begins. Feedback about response accuracy was presented on the screen for 500 ms following a response. If the participant was not satisfied with his/her ability to detect the gap, he/she had the option of completing the practice trials again until comfortable with the task.

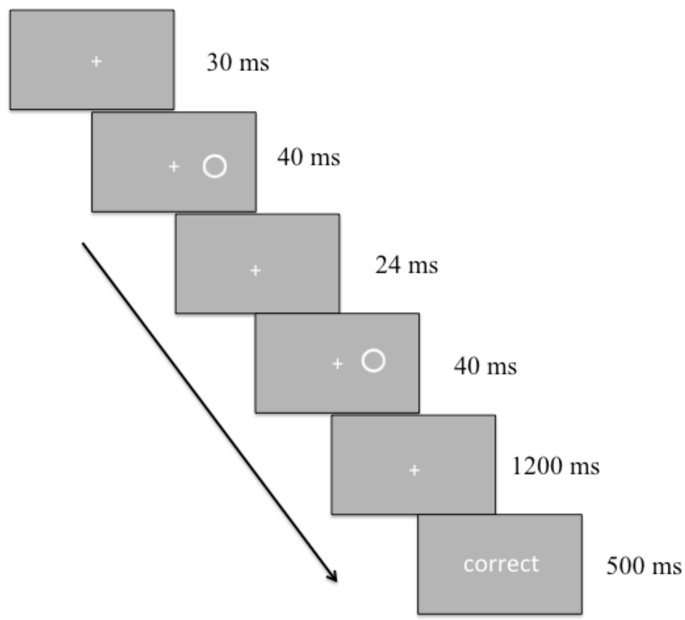

Figure 3. Temporal Gap Detection Practice Trial. This sample shows the progression of the practice trials for the temporal task from start to finish.

Following the practice trials, participants completed 240 experiment trials. Half of the trials presented happy faces as emotional cues on the left and right sides of the fixation point, and half presented neutral faces. Face cues appeared for 70 ms after a 1000 ms fixation period, and were followed by a subsequent 30 ms fixation period. Next, in half of the experimental trials, a Landolt circle was presented for a varying amount of time, 42, 35, or 28 ms, before it disappeared for 14 ms, 28 ms, or 42 ms, respectively, and then reappeared for 42 ms, 35 ms, or 28 ms, respectively. In total, the stimulus duration was held to 98 ms across all trials, and there were 40 trials for each temporal gap size. The flickering Landolt circle was equally likely to appear on the left or right side of the display. In the other half of the trials, a Landolt circle with no gap was presented for 98 ms on the left or right side of the display. Participants were given 1200 ms to indicate if they perceived a gap or not, and their responses were followed with a display that provided accuracy feedback for 500 ms. Participants' responses were coded for hits, misses, correct rejections, and false alarms, which are then used to calculate gap discriminability scores for each emotional cues type (positive versus neutral) and gap size (14, 28, and 42 ms).

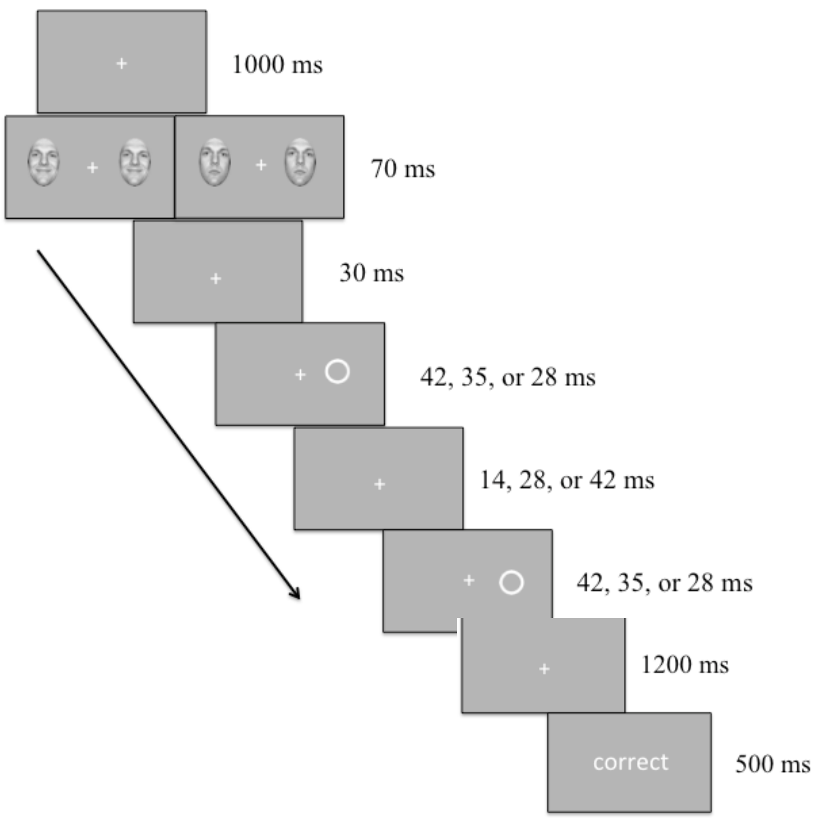

Figure 4. Temporal Gap Detection Experimental Trial. This sample shows the progression of the experimental trials for the temporal task from start to finish.

Emotion Recognition Test. To measure emotion recognition ability, participants completed two emotion judgment tasks. The first task required participants to indicate which emotion they perceived in face pairs presented on the left and right side of a fixation point for 70 ms (fast paced), as in the spatial and temporal gap detection tasks. There were 40 trials, and participants were given a 1200 ms response window for each trial. Feedback about response accuracy was not provided. During the second judgment task, participants were presented with individual faces at the center of the display and had as much time as needed to report a judgment (self-paced) indicating whether the stimulus is a happy face or a neutral face. The purposes of completing these two tasks were to (a) determine if participants were conscious of the emotional cues that were presented for 70 ms, and (b) to ensure that participants perceived the appropriate emotion in each expression when they had no time pressure to respond.

Individual Difference Measures. In addition to the main experimental gap detection task, participants completed additional measures that were used for exploratory purposes to assess individual differences in gap detection performance. These additional measures included the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1997), the Behavior Inhibition Scale/Behavior Activation Scale (BIS/BAS; Carver & White, 1994), a brief 10-item Big Five personality inventory (Rammstedt & John, 2007), a short cognitive battery (processing speed and vocabulary; Ekstrom, French, Harman, & Dermen, 1976), and a brief demographics questionnaire. These measures are included in Appendix A through D. Additionally, visual acuity data were collected at the outset of the experiment to confirm that participants could see and decipher stimuli on the screen.

Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1997). The CES-D (see Appendix A) was designed to assess depressive symptoms in the general population. Participants are asked to respond to 20 multiple-choice items that assess the frequency of experienced feelings associated with depression during the past week (Radloff, 1977). Response options use a four-point frequency scale ranging from a = *rarely or none of the time (less than one day)* to d = *most or all of the time (5-7 days)*. The internal consistency of the CES-D among the general population is .85 (Radloff, 1977). For the current study, internal consistency of the CES-D was .84.

Behavior Inhibition Scale (BIS)/ Behavior Activation Scale (BAS) (BIS/BAS; Carver & White, 1994). The BIS/BAS (see Appendix B) scales measure one's preference to move toward something desired or away from something unpleasant. Participants indicate to what extent they agree or disagree with 24 statements using a four-point Likert rating scale. Responses range from 1 = *very true for me* to 4 = *very false for me*. The items are divided into 4 subscales: BAS Drive, BAS Fun Seeking, BAS Reward Responsiveness, and BIS. Internal consistency for each subscale of the BIS/BAS ranges from .66 to .75 (Carver & White, 1994). For the current study, the internal consistency for each subscale was the following: BAS Drive α = .62, BAS Fun Seeking α = .62, BAS Reward Responsiveness α = .27, and BIS α = 67.

***Big Five Inventory (*Rammstedt & John, 2007).** The abbreviated version of the Big Five Inventory (BFI-10; see Appendix C) measures the following personality dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism (Rammstedt & John, 2007). Two items account for each dimension. Participants rate each of the 10 items on a five-point Likert scale indicating the extent to which each statement pertains to his/her personality. The test-retest reliability after a six-week period is .72 (Rammstedt & John, 2007).

Advanced Vocabulary Test. This test is part of the Kit of Factor-Referenced Tests (Ekstrom, French, Harman, & Dermen, 1976), and is comprised of 36 items that assess knowledge of word meanings. Participants must identify which word in a set of five has the same or similar meaning as a word listed above. Participants are given four minutes to complete each of the two parts of the test. The test is scored based upon the number of items marked correctly, with a maximum 36 possible points. Internal consistency for this measure is .94 (Ekstrom et al., 1976).

Finding A's Speed Test. The Finding A's Speed test is also from the Kit of Factor-Referenced Tests (Ekstrom et al., 1976), and assesses perceptual/processing speed. Participants are given two minutes to cross out as many words that contain the letter "a" as possible. Each page includes 6 columns of words, and each column has five words containing the letter "a." Overall, there are five pages to this test, with a maximum possible score of 150 items correct. Internal consistency for this measure is .82 (Ekstrom et al., 1976).

Demographics questionnaire. The questionnaire is comprised of 30 items (see Appendix D). Information was gathered on our participants' gender, marital status, date of birth, native language, major, education level, employment status and duties, extent of participation in volunteer activities with young adults, status of health, treatment history for anxiety and depression, and hearing, writing, or vision difficulties.

Collenbrander Snellen Visual Acuity Test. Participants were prompted to read from a placard containing a number of lines of printed type that grows smaller in size until they reach the line of print containing the smallest type that they can accurately read. The test was run at a one meter distance from the placard, and participant visual acuity values were converted to the logarithm of the minimum angle of resolution (log MAR) after being recorded.

Procedure

All participants were provided with informed consent (see Appendix E) upon arrival, which informed students of the minimal risk of the experiment, as well as their right to withdraw from the experiment at any time. The purpose of the current study was explained to participants. Participants completed the visual acuity screening after agreeing to the conditions of the experiment. Participants then completed the individual difference measures for personality, cognitive functioning, and depression before completing one of the two gap detection tasks followed by the emotion recognition tasks. After all computer tasks were completed. Participants were then debriefed and awarded WKU Study Board Credit.

Results

Participant Demographics

Independent-samples *t*-tests were conducted on the individual differences measures used in this experiment to examine whether group assignment differences emerged. Participants were assigned to one of two between-subjects groups, the spatial gap detection task group or temporal gap detection task group. There was a significant difference in scores on the CES-D scale between groups; $t(35) = -2.91$, $p = .006$, such that depression scores were higher for those who completed the spatial gap detection task ($M = 16.1$, $SD = 6.3$) than for those who completed the temporal gap detection task ($M =$

9.9, *SD* = 6.6). Additionally, participants who completed the temporal gap detection task (*M* = 2.6, *SD* = 1.2) were less neurotic than those who completed the spatial gap detection task (*M* = 3.5, *SD* = 1.2); $t(24) = -2.52$, $p = .017$. Additional group means can be found in Table 1 for the other individual difference measures. Groups were matched on visual acuity and all other individual differences measures.

Table 1. *Individual difference measures' means and standard deviations by task type.*

Measure	Temporal Task (*n* = 19)		Spatial Task (*n* = 17)		
	Mean	SD	Mean	SD	*t*(df)
Acuity	0.02	0.04	0.05	0.08	*t*(35) = 1.83
CES-D**	9.89	6.62	16.06	6.25	*t*(35) = -2.91**
BAS					
Drive	2.11	0.44	2.10	0.54	*t*(34) = .01
Reward	1.38	0.25	1.40	0.30	*t*(34) = .23
Fun Seeking	2.01	0.54	1.72	0.58	*t*(34) = .13
BIS	2.20	0.51	1.92	0.52	*t*(34) = 1.63
View of Self					
Openness	3.84	0.80	4.03	0.82	*t*(34) = -.69
Conscientiousness	4.00	0.67	3.50	0.92	*t*(34) = 1.88
Extraversion	2.95	0.86	3.00	0.95	*t*(34) = -.17
Agreeableness	4.13	0.70	3.74	0.59	*t*(34) = 1.82
Neuroticism*	2.63	0.98	3.53	0.15	*t*(34) = -2.52*
Advanced Vocabulary	12.00	3.74	13.71	4.19	*t*(33) = -1.27
Finding A's Test	26.00	7.23	24.24	7.44	*t*(34) = .72

Note: ** $p < .01$; * $p < .05$; Measurement scales: Visual Acuity in log MAR (Minimum Angle of Resolution); CES-D 0-60 total score; the subscales of the BAS, BIS, and View of Self Inventories 5-point Likert ratings; Vocabulary 0-36 total score; Finding A's total score 0-150.

Gap Detection Task Performance

Gap Discriminability. To measure the participants' gap detection abilities, *d'* values were calculated based upon the hit rates and false alarm rates displayed by each participant separately for each gap detection task. The score reflects the degree to which participants could distinguish between trials in each task that did and did not include perceptual gaps. Of the 39 participants who completed the study, data for two participants were excluded due to high false alarm rates, indicative of a failure to adhere to experimental instructions while completing the temporal task. Overall, 19 participants were assigned to the Temporal Task Group and 18 participants to the Spatial Task Group. A 2 (emotional cue: happy vs. neutral) x 2 (task type: temporal task vs. spatial task) x 3 (task difficulty: small vs. medium vs. large gap sizes) mixed-model analysis of variance (ANOVA) was conducted, in which emotional cue and task difficulty were within-subjects factors and task type was a between-subjects factor. Consistent with expectation, the analysis revealed a significant main effect of gap size; $F(2, 68) = 5.20$, $p = .008$, $\eta_p^2 = .13$. Means and standard errors for performance at each level of gap size are displayed in *Figure 5*. Post hoc Sidak comparisons were performed to examine this main effect. Gap detection was more difficult for the smallest gap relative to the larger two gaps (Versus medium size gap $p = .045$; versus large size gap $p = .028$). There was no main effect of emotion, $F(1, 34) = .44$, $p = .18$, $\eta_p^2 = .05$, or task type, $F(1, 34) = .44$, $p = .25$ $\eta_p^2 =. 01$. Inconsistent with expectations, no interactions emerged, including the task type by emotion interaction that was hypothesized based on prior research; $F(1, 34) = .32$, $p = .57$, $\eta_p^2 = .01$. Note that the means and standard errors for each task type are depicted in *Figure 6* for each type of facial cue. Overall, gap detection did not vary based upon the task type or the type of emotion that was presented before each gap judgment but did vary based on the difficulty of the judgment. Generally speaking, this suggests that participants paid little attention to the emotional cues but did pay attention to the stimuli in order to identify the presence or absence of a gap.

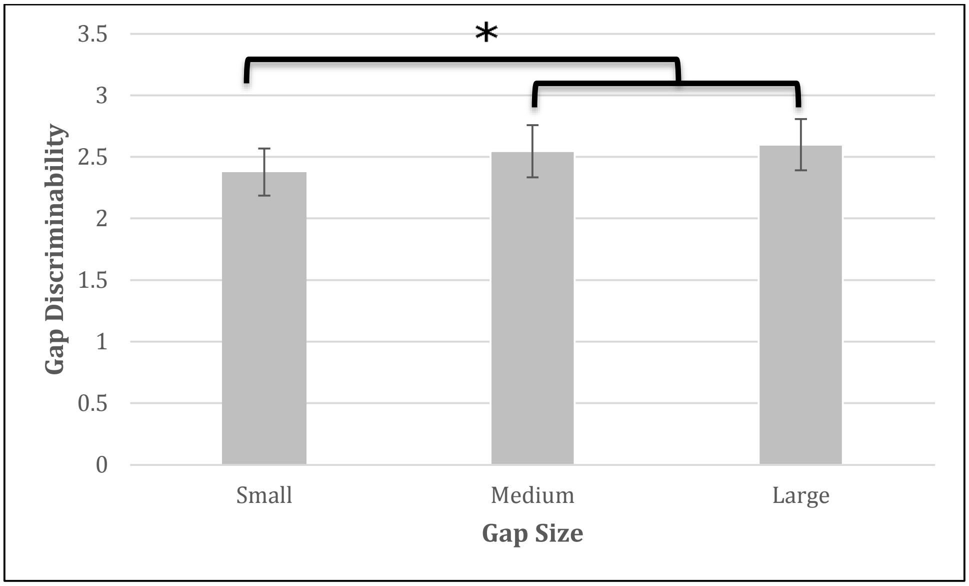

Figure 5. Gap size main effect based upon participant *d'* values (error bars indicate *SE*)

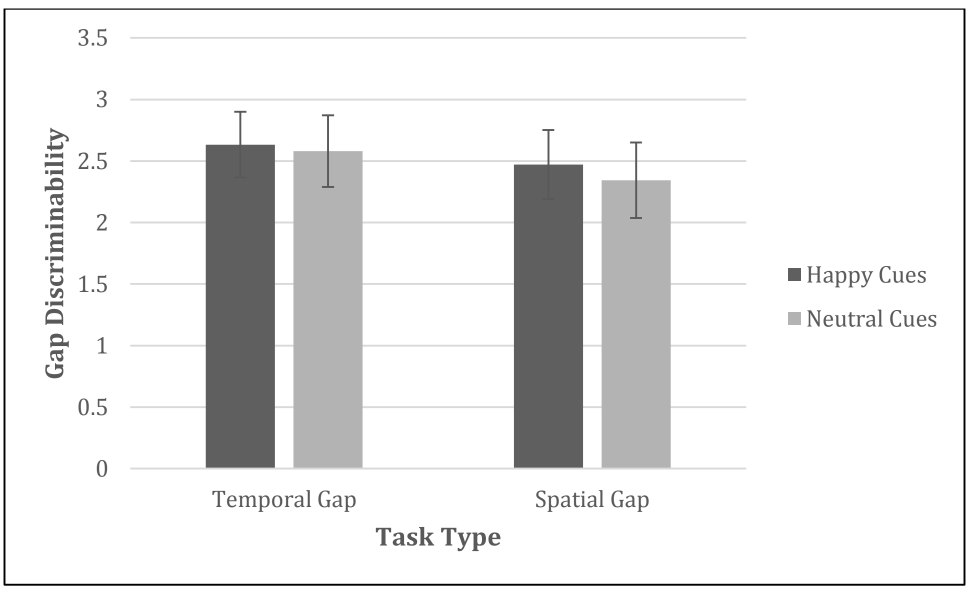

Figure 6. Emotion Cue x Task Type Interaction based on participant *d'* values (error bars indicate *SE*).

Given that there were significant differences between the participants in the spatial and temporal tasks on the CES-D scale and the Neuroticism subscale, separate analyses were performed to assess the impact of these covariates on gap detection performance. The first analysis of covariance revealed no main effect of emotion or task type but did reveal that depression scores were a significant covariate, $F(1, 33) = 7.95$, $p = .008$, $\eta_p^2 = .19$. The covariate did not interact with the other within-subjects factors, yielding the same statistical outcomes from the aforementioned ANOVA. However, the main effect of gap size was attenuated and is now marginal, $F(2, 66) = 2.98$, $p = .057$, $\eta_p^2 = .08$. The second analysis of covariance revealed that there was no main effect of emotion or task type, and neuroticism scores were not a significant covariate, $F(1, 32) = 1.17$, $p = .29$, $\eta_p^2 = .04$. Neuroticism did not interact with the within subjects variables but did attenuate the main effect of gap size; $F(2, 64) = 2.84$, $p = .07$, $\eta_p^2 = .08$.

Reaction Time. Within experimental psychology research that utilizes accuracy as a dependent variable, the failure to find expected results within accuracy data leads one to question whether participants prioritized accuracy at the expense of response time. This would lead to less variability in accuracy or discriminability measures but greater variability in the time that participants used to respond to trials within each condition. Consequently, a 2 (emotional cue: happy vs. neutral) x 2 (task type: temporal vs. spatial task) x 4 (gap size: no gap vs. small vs. medium vs. large gap sizes) mixed-model ANOVA was conducted on the participants' response times on accurate trials to determine if the absence of emotion-related effects in the gap discriminability measure emerged due to systematic differences in response times instead of accuracy. The ANOVA revealed no significant main effects of emotional cue, $F(1, 34) = .55$, $p = .47$,

η_p^2 = .02, or task type, $F(1, 34) = .06$, $p = .82$, $\eta_p^2 = .00$. However, the main effect of gap size was marginal, $F(3, 102) = 2.32$, $p = .08$, $\eta_p^2 = .06$. Sidak post-hoc tests revealed that reaction time for trials with the smallest gap (*M* = 761, *SE* = 13*)* was significantly greater than reaction time on trails with the largest gap (*M* = 460, SE = 11; *p* = .015). The ANOVA yielded a significant interaction between gap size and task type; $F(3, 102) = 3.59$, $p = .02$, $\eta_p^2 =.10$. Those who completed the temporal gap detection task had slower reaction times to no gap trials relative to trials with gaps, but this is only a mean trend. Those who completed the spatial gap detection task had slower reaction times to trials that included stimuli with the smallest gap relative to trials that included stimuli without gaps (*p* = .059) or stimuli with largest gaps (*p* = .023), as revealed by Sidak post-hoc comparisons performed during a 2 (emotion) x 4 (gap size) repeated measures ANOVA on the participants' gap detection performance in the spatial gap detection task. See mean reaction times and standard errors depicted in *Figure 7*. In order for the hypothesis from the current study to be supported, participants would have had to (a) use less time to respond to trials in the temporal gap detection task after having been cued with happy facial expressions than after having been cued with neutral facial expressions, and/or (b) use more time to respond to trials in the spatial gap detection task after having been cued with happy cued with happy facial expressions than after having been cued with neutral facial expressions. This interaction between emotional cue and task type was not significant; $F(1, 34) = .22$, $p = .64$, $\eta_p^2 = .01$(see mean reaction times and standard errors depicted in *Figure 8*).

Given that there were significant differences between the participants in the spatial and temporal tasks on the CES-D scale and the Neuroticism subscale, separate analyses were performed to assess the impact of these covariates on reaction time. The first analysis of covariance revealed no main effect of emotion or task type. Depression scores were not a significant covariate, $F(1, 33) = .06$, $p = .82$, $\eta_p^2 = .00$, and did not attenuate the interaction between gap size and task type, $F(3, 99) = 2.97$, $p = .04$, $\eta_p^2 = .08$. The second analysis of covariance revealed that there was no main effect of emotion or task type, and neuroticism scores were not a significant covariate, $F(1, 32) = .09$, $p = .77$, $\eta_p^2 = .00$. Neuroticism did not interact with the within subjects variables and did not attenuate the main effect of gap size; $F(3, 96) = 3.10$, $p = .03$, $\eta_p^2 = .09$.

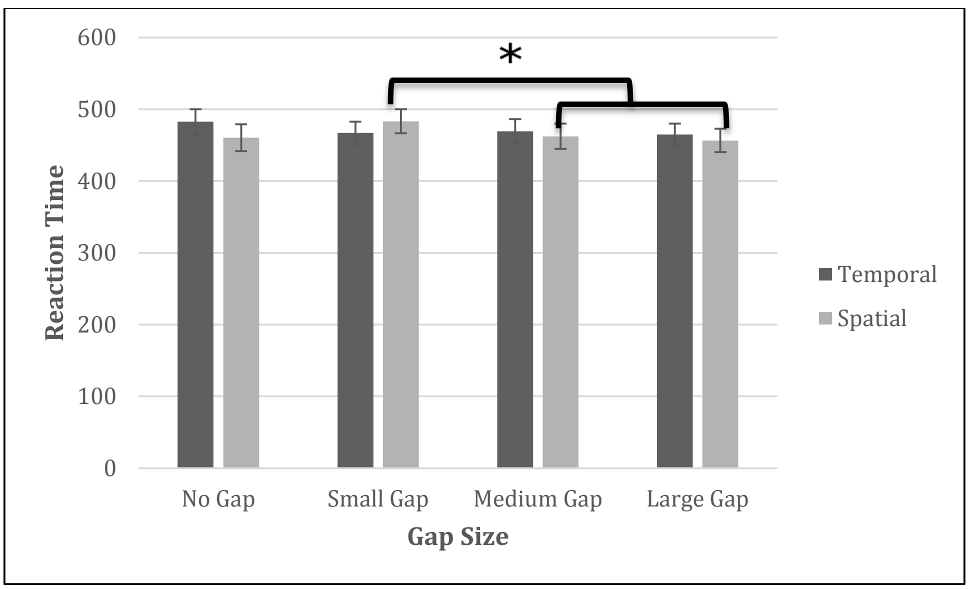

Figure 7. Gap Size x Task Type Interaction based on participant reaction times (error bars indicate *SE*).

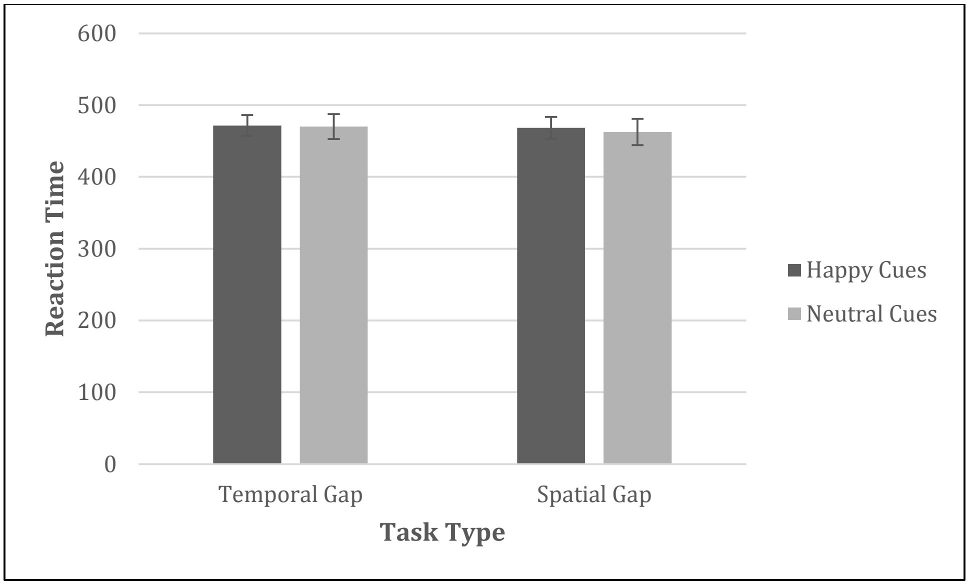

Figure 8. Emotional Cue x Task Type Interaction based upon participant reaction times (error bars indicate *SE*).

Emotion Recognition Task Performance

Participants also completed two different emotion recognition tasks. In one task (fast pace), participants viewed each facial stimulus presented at a fast pace (70 ms stimulus duration) identical to that used in the gap judgment task and then indicated whether it was a happy face or a neutral face. In the other (self-paced), participants viewed the same facial stimuli and made the exact same judgment, but the stimuli were presented centrally and were self-paced so that the participant could have as long he/she needed to make a judgment. A 2 (emotion: happy vs. neutral) x 2 (task speed: fast vs. self-paced) x 2 (gap task type: spatial vs. temporal) mixed model ANOVA, with emotion and task speed as within-subjects variables and gap task type as a between-subjects variable, revealed a significant main effect of task speed; $F(1, 34) = 4.18$, $p = .049$, $\eta_p^2 = .11$, such that participants had greater response accuracy in recognizing emotion during the self-paced task ($M = 94.8\%$, $SE = 1.0\%$) than during the fast paced task ($M = 80.4\%$, *SE* = 2.0%). Additionally, the ANOVA revealed a significant main effect of emotion; $F(1, 34) = 42.7$, $p < .001$, $\eta_p^2 = .56$, such that participants were significantly more accurate at recognizing neutral expressions (*M* =89.2%, *SE* = 2.0%) than happy expressions (*M* = 85.8%, *SE* = 2.0%).

Given that there were significant differences between the participants in the spatial and temporal tasks on the CES-D scale and the Neuroticism subscale, separate analyses were performed to assess the impact of these covariates on gap detection performance. The first analysis of covariance revealed that depression scores were not a significant covariate, $F(1, 33) = .28$, $p = .60$, $\eta_p^2 = .01$, and did not attenuate the main effect of task speed, $F(1, 33) = 6.63$, $p = .02$, $\eta_p^2 = .17$, and emotion, $F(1, 33) = 4.99$, $p = .03$, $\eta_p^2 = .13$. The covariate did not interact with the other within-subjects factors, yielding the same statistical outcomes from the aforementioned ANOVA.

Discussion

The current study examined the impact of positive emotion on early visual processes. Specifically, the experiment was designed to further investigate the influence, if any, the presentation of positive emotional cues prior to a gap detection task would have on facilitating temporal gap discriminability and inhibiting spatial gap discriminability. Evidence suggests that the presentation of an emotional cue, in particular a fearful facial cue, promotes higher accuracy in detecting a flicker in a circle stimulus relative to a neutral facial cue and that a fearful facial cue impairs the detection of a missing segment in a circle stimulus relative to a neutral cue (Bocanegra & Zeelenberg, 2011a). These findings can be explained by differences in the properties of stimuli that activate magnocellular and parvocellular channels responsible for stimulus perception.

The current study sought to extend these findings from fearful cues to positive emotional cues by presenting happy face cues within trials found in temporal and spatial gap detection tasks reported in the literature (Bocanegra & Zeelenberg, 2011a). Given past research on the role that positive emotion plays in enhancing stimulus processing, the current study was designed to determine if one could infer that the enhanced temporal gap perception that emerges after the onset of negative emotional cues also emerges after the onset of positive cues. Were the findings to generalize, one might then claim that perhaps the amygdala treats positive emotional cues in the same manner as negative ones, signaling to cortical regions via magnocellular pathways in such a way to facilitate the use of perceptual resources to evaluate the temporal stimulus gap. The predictions, however, were not supported; gap discriminability in temporal and spatial gap detection tasks did not differ as a function of the emotional cues presented.

An inability to generalize the findings of previous research is not totally indicative of failure. Rather, several significant conclusions can be drawn from these results. Bocanegra and Zeelenberg (2011a) proposed a trade-off between the act of deciphering the location and timing of a stimulus versus analyzing the more fine-grained details of the stimulus's make-up, and found that such a trade-off was supported by the use of emotional cues in spatial and temporal gap detection tasks. Due to responsiveness of the amygdala to positive stimuli and its connections to the visual system, a similar trade-off was expected in the current study. The absence of support for this trade-off in the current study is not completely inconsistent with prior research.

There are discrepancies in the literature with respects to amygdalar reactivity to positive emotion that may explain these findings. For example, damage to cortical regions associated with processing emotional stimuli has been shown to interfere with one's ability to identify negative emotion. However, this response did not transfer over to the identification of positive emotion (Blair et al., 1999, Cardinal et al., 2002; Morris et al., 1998; Vuilleumier et al., 2004). As demonstrated by Hamann and colleagues (2002), amygdalar reactivity to positive emotion was more concentrated in the left amygdala and bilaterally for negative emotion. It is possible that the cortical and subcortical regions of the brain, although still responsive, process negative emotional stimuli (like threatening stimuli) differently than positive emotional stimuli. In other words, although the same regions might be activated in the context of a neuroimaging study, the timing of activation of these regions as well as the resulting behavioral response might produce different outcomes (e.g., avoidance versus approach).

Research has failed to show that the presentation of positive emotional cues impacts subsequent behavioral responses. In the current study, it is possible that gap detection was independent of the influence of the emotional cues and was a function of task difficulty. The analyses confirmed that the participants were consciously aware of the emotional cues used in the gap detection tasks and could identify the emotion displayed when the facial stimuli were presented at the same rate that they were presented in the experimental trials. Also, as expected, participants had greater difficult detecting the small gap condition on the spatial task. Interestingly, participants in the temporal gap condition had the greatest difficulty identifying circles with no gap (i.e., no flicker). It is possible that the amygdala is simply less sensitive to positive emotion than negative emotion.

Although both types of stimuli activate the amygdala, the consequence of the activation on future behavior is less impactful when emerging in response to positive stimuli than to negative stimuli. A negativity bias in which aversive stimuli elicit a more intense response than do pleasant stimuli is adaptive because of the need to protect one's self from threat in one's environment. The negativity bias documented in the literature for simple target detection tasks like the one employed in the current study is also consistent with decades of research examining our fight or flight response to threat (Carretie, Albert, Lopez-Martin, & Tapia, 2009; Levenson, 1992; Pessoa, 2013) as well as the attention capturing effects of negative emotional faces in a crowd of neutral ones (Ohman, Lundqvist, & Esteves, 2001). Liberzon and colleagues (2003) suggest that aversive stimuli are more immediately salient than positive stimuli, given their implications for threat and biological relevance. While pleasant stimuli are arguably of equal biological relevance, the demand of immediacy in orienting toward and responding to these stimuli is not as great for survival.

Stimulus habituation may also explain the absence of significant results in this study. Compiled fMRI data revealed a habituation-like response in amygdalar activity when viewing fearful and happy facial stimuli (Breiter et al., 1996; Wright et al., 2000). Ultimately, the stimuli become less arousing with repeated presentation, creating a weaker response to the once novel stimulus. In the current study, each happy facial cue was presented 24 times (120 happy faces total) within each gap detection task. However, the procedure for the current study was derived from researchers who did not observe this effect in their study and were able to measure the expected outcomes.

Limitations and Future Considerations

The current study is limited in that participants in each experimental group differed significantly on measures of depression and personality dimensions, specifically the neuroticism scale. Hamann and Canli (2004) conducted a literature review on individual differences that impact amygdala in response to emotion. They found that dispositional pessimism correlated with prolonged amygdalar activations when presented with aversive stimuli. Additionally, their research revealed that neuroticism was associated with differences in activations when presented with negative emotion (Hamann & Canli, 2004). It is possible that neuroticism also impacts individual differences in the reactivity to positive emotional stimuli, given that highly neurotic individuals have a tendency to focus more on their inner anxieties and less on emotionally reassuring appraisals (Austin, Dore, & O'Donovan, 2008; Rafienia, Azadfallah, Fathi-Ashtiani, & Rasoulzadeh-Tabatabaiei, 2008). Statistically speaking, any group assignment differences in neuroticism had no impact on the findings of this study.

As mentioned above, participants were instructed to passively view the emotional faces and did not have to use the emotion on the facial cues for any purpose. As a result, the participants might have simply ignored the facial cues. Prior studies implemented the same protocol and instructions used in the current study, so, if this were problematic in the current study, one might expect similar difficulties to emerge in other studies reported in the literature. To understand the impact, if any, of positive emotion on early visual processes, future researchers should examine behavioral responses on these tasks while at the same time requiring the participant to actively engage the emotional stimuli. For example, this could mean instructing participants to identify the emotion of the facial cue every specified number of trials. It is difficult to conclude that our participants were not motivated for the task, as response accuracy in identifying the type of gap presented and performance on the emotion recognition task were high. It is possible that in order to see an effect of positive emotional stimuli on detection of a gap in spatial or temporal tasks, emotion must be relevant to the task or somehow more salient to the participant.

Conclusion

Although the current study was unable to replicate Bocanegra and Zeleenberg's (2011a) findings, important conclusions can be drawn from this research. Studies consistently demonstrate that the amygdala is responsive to aversive and pleasant stimuli. However, neuroimaging studies also reveal that the activation differs in the presence of the type of emotional stimuli, specifically having a more intense and sustained reaction to negative emotional stimuli (Hamann et al., 2002; Liberzon et al., 2003; Vuilleumier et al., 2004). Amygdalar reactivity to positive emotion as compared to negative emotion may have less of an impact on subsequent behavioral responses. More research is needed to better understand the impact, if any, that positive emotion has on spatiotemporal vision.

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APPENDIX A
Feelings Scale

<u>Instructions</u>: In this booklet, there are statements about the way that most people feel at one time or another. There is no such thing as a "right" or "wrong" answer because all people are different. All you have to do is answer the statements according to how you have felt during the past week. Don't answer according to how you USUALLY feel, but rather how you have felt DURING THE PAST WEEK. Each statement is followed by four choices. ***<u>Circle</u>*** the letter corresponding to your choice. Mark ONLY ONE letter for each statement. For example:

During the past week, I was happy.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

In the example, you could, of course, choose any ONE of the answers. If you felt really happy, you would circle “d”. If you felt very unhappy, you would circle “a”. The “b” and “c” answers give you middle choices. Keep these following points in mind.

1. Don't spend too much time thinking about your answer. Give the 1st natural answer that comes to you.

2. Do your best to answer EVERY question, even if it doesn't seem to apply to you very well.

3. Answer as honestly as you can. Please do not mark something because it seems like "the right thing to say".

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1. During the past week, I was bothered by things that don’t usually bother me.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

2. During the past week, I did not feel like eating. My appetite was poor.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

3. During the past week, I felt that I could not shake off the blues even with help from my family or friends.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)

d. Most or all of the time (5 - 7 days)

4. During the past week, I felt that I was just as good as other people.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

5. During the past week, I had trouble keeping my mind on what I was doing.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

6. During the past week, I felt depressed.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

7. During the past week, I felt that everything I did was an effort.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

8. During the past week, I felt hopeful about the future.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

9. During the past week, I thought my life had been a failure.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

10. During the past week, I felt fearful.

   a. Rarely or none of the time (less than one day)
   b. Some or a little of the time (1 - 2 days)
   c. Occasionally or a moderate amount of time (3 - 4 days)
   d. Most or all of the time (5 - 7 days)

11. During the past week, my sleep was restless.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

12. During the past week, I was happy.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

13. During the past week, I talked less than usual.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

14. During the past week, I felt lonely.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

15. During the past week, people were unfriendly.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

16. During the past week, I enjoyed life.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

17. During the past week, I had crying spells.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

18. During the past week, I felt sad.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

19. During the past week, I felt that people dislike me.

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

20. During the past week, I could not get "going".

a. Rarely or none of the time (less than one day)
b. Some or a little of the time (1 - 2 days)
c. Occasionally or a moderate amount of time (3 - 4 days)
d. Most or all of the time (5 - 7 days)

APPENDIX B
BIS/BAS

<u>Instructions</u>: Each item of this questionnaire is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Please respond to all the items; do not leave any blank. Choose only one response to each statement. Please be as accurate and honest as you can be. Respond to each item as if it were the only item. That is, don't worry about being "consistent" in your responses. Choose from the following four response options:

1 = very true for me
2 = somewhat true for me
3 = somewhat false for me
4 = very false for me

_____ 1. A person's family is the most important thing in life.

_____ 2. Even if something bad is about to happen to me, I rarely experience fear or nervousness.

_____ 3. I go out of my way to get things I want.

_____ 4. When I'm doing well at something I love to keep at it.

_____ 5. I'm always willing to try something new if I think it will be fun.

_____ 6. How I dress is important to me.

_____ 7. When I get something I want, I feel excited and energized.

_____ 8. Criticism or scolding hurts me quite a bit.

_____ 9. When I want something I usually go all-out to get it.

_____ 10. I will often do things for no other reason than that they might be fun.

_____ 11. It's hard for me to find the time to do things such as get a haircut.

_____ 12. If I see a chance to get something I want I move on it right away.

_____ 13. I feel pretty worried or upset when I think or know somebody is angry at me.

_____ 14. When I see an opportunity for something I like I get excited right away.

_____ 15. I often act on the spur of the moment.

_____ 16. If I think something unpleasant is going to happen I usually get pretty "worked up."

_____ 17. I often wonder why people act the way they do.

_____ 18. When good things happen to me, it affects me strongly.

_____ 19. I feel worried when I think I have done poorly at something important.

_____ 20. I crave excitement and new sensations.

_____ 21. When I go after something I use a "no holds barred" approach.

_____ 22. I have very few fears compared to my friends.

_____ 23. It would excite me to win a contest.

_____ 24. I worry about making mistakes.

APPENDIX C

View of Self (VoS) Survey

Instructions: For this survey, we are interested in knowing how well each of the following statements describes your personality. Using the rating scale (1 to 5) provided below, please indicate how much you agree with each of the following statements. Please indicate your response by ***writing a number in the space next to each statement***.

1	2	3	4	5
Disagree strongly	**Disagree a little**	**Neither agree nor disagree**	**Agree a little**	**Agree strongly**

______ 1. I see myself as someone who is reserved.

______ 2. I see myself as someone who is generally trusting.

______ 3. I see myself as someone who tends to be lazy.

______ 4. I see myself as someone who is relaxed, handles stress well.

______ 5. I see myself as someone who has few artistic interests.

______ 6. I see myself as someone who is outgoing, sociable.

______ 7. I see myself as someone who tends to find fault with others.

______ 8. I see myself as someone who does a thorough job.

______ 9. I see myself as someone who gets nervous easily.

______ 10. I see myself as someone who has an active imagination.

Handedness: LEFT or RIGHT

Vision: 20 / ____

APPENDIX D
Lab Demographics Questionnaire

<u>Instructions</u>: The items in this questionnaire ask you for personal information that we can use to get a sense for how similar our group of volunteers is to those who participate in research at other institutions in the United States. All information that we collect from individuals will not be linked back to their identities. However, if you are uncomfortable providing a response for any of the following items, please do not respond to them. For the remaining items, please ***fill in the blank spaces*** or ***circle the response*** which best describes you.

1. **Please indicate your gender:** 1. Female 2. Male

2. **Please indicate your marital status:**
   1. Single
   2. Married
   3. Domestic Partnership
   4. Divorced
   5. Widowed
   6. Other (specify) ____________________

3. Please indicate how many children you have raised or are currently raising. _____

4. Date of birth: _____/_____/_____ **and current age: ___________** years

5. Do you consider yourself to be Hispanic or Latino? 1. YES 2. NO

6. Please indicate your racial background:
1. American Indian/ Alaska Native
2. Asian
3. Native Hawaiian or Other Pacific Islander
4. Black or African American
5. Caucasian
6. More than one race (specify)___________________
7. Other (specify) _____________________________

6b. Is English your native language? 1. Yes 2. No

7. Please indicate your religious faith:
1. Christian (Protestant or Catholic)
2. Jewish
3. Hindu
4. Muslim
5. Buddhist
6. None (e.g., atheist)
7. Other (specify) ___________________

8. Are you a student? 1. Yes - full time 2. Yes - part time 3. No

To continue, please turn to the other side of this page

9. If you are a student, please indicate your academic major:

1. Arts (specify) ____________________________
2. Business (specify) ____________________________
3. Engineering (specify) ____________________________
4. Humanities (specify) ____________________________
5. Science (specify) ____________________________
6. Health (specify) ____________________________
7. Education (specify) ____________________________
8. Other (specify) ____________________________

10. What is your highest level of formal education (circle the highest level <u>completed</u>):

A. Less than 12 years (How many of years completed? _________ years)
B. GED (Age when you completed your GED: _______)
C. High school diploma
D. Technical/ Vocational/ Trade school diploma or certificate
E. College Freshman
F. College Sophomore
G. College Junior
H. Associate's Degree
I. Bachelor's degree
J. Master's degree
K. J.D., M.D., or Ph.D.

11. Are you presently employed: 1. Yes - full time 2. Yes - part time 3. No

12. Are you presently retired? 1. Yes 2. No

13. If you are currently or have recently been employed, what field is your job in?

____

14. If you are currently or have recently been employed, please describe the duties of your job?

____

____

15. In the past 5 years, have you engaged in volunteer activities to assist or instruct young adults (i.e., individuals aged 18-30)? 1. Yes 2. No

16. To what extent do you interact with young adults throughout the course of a typical week (including time spent at work, in classes, and/or during volunteer or extracurricular activities)?

1. Rarely or none of the time (less than one day)
2. Some or a little of the time (1 - 2 days)
3. Occasionally or a moderate amount of time (3 - 4 days)
4. Most or all of the time (5 - 7 days)

17. How would you rate your overall health at the present time? (please circle one rating)

1. Poor 2. Fair 3. Good 4. Very Good 5. Excellent

18. How much do health problems stand in your way of doing things that you want to do? (please circle one rating)

1. Not at all 2. A little 3. Moderately 4. Quite a bit 5. A great deal

19. Are you presently seeking psychological or psychiatric consultation and/or receiving therapy?

1. Yes 2. No

If <u>yes</u>…

a. Are you currently being treated for depression? 1. Yes 2. No

b. Are you currently being treated for excessive anxiety or nervousness? 1. Yes 2. No

20. Do you currently have any noticeable difficulty with vision for which correction, such as eyeglasses, has <u>NOT</u> been made? 1. Yes 2. No

21. Do you currently have any noticeable difficulty with hearing for which a correction, such as a hearing aide, has <u>NOT</u> been made? 1. Yes 2. No

22. Do you currently have any difficulty with writing? 1. Yes 2. No

Appendix E

INSTITUTIONAL REVIEW BOARD
WKU
APPROVED

PARTICIPANT INFORMED CONSENT DOCUMENT

Project Title: Faces and Spaces
Principal Investigator: Dr. Andrew Mienaltowski,
Psychological Sciences, WKU, (270) 745-2353
Co-Investigator: Siera Bramschreiber, Psychology, WKU, (270) 745-2229

You are being asked to participate in a project conducted through Western Kentucky University. The University requires that you give your signed agreement to participate in this project.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and the possible risks of participation. You are welcome to ask any questions that you might have to help improve your understanding of the project. A basic explanation of the project is written below. Please read this explanation and discuss any questions that you might have with the researcher.

If you decide to participate in the project, please sign on the last page of this form in the presence of the person who explained the project to you. You should be given a copy of this form to keep.

A. Nature and Purpose of the Project:

This project is examining how people detect physical or timing gaps in stimuli (e.g., a circle) that are presented on a computer screen.

B. Explanation of Procedures:

The purpose of this research is to evaluate how quickly and accurately observers can detect a physical gap and/or a timing gap in a circle stimulus that is presented fairly quickly on a computer display. During the physical gap task, you will be asked to indicate when you detect that a piece of a circle has been removed and when you are seeing a fully intact circle. During the timing gap task, you will be asked to indicate when you detect that a quickly presented circle stimulus has flickered on the screen. The gap size will vary from one trial to the next, so some trials will be harder than others. Additionally, you will be asked to judge the emotional content of photos of facial expressions that are presented quickly on a computer display. Participants in the study are also asked to complete a short series of personality tests and cognitive abilities tests. The purpose of these tests is to determine if individual differences in your ability to detect the gap are related to social, motivational, or cognitive differences between participants. Any connection that exists likely occurs outside of our awareness and may not be purposefully controlled.

C. Discomforts and Risks of Participation:

There are no known risks associated with participation in these experiments. However, should you become tired, you are free to quit at any time. There are opportunities to take breaks between tasks in the experiment. Please do not hesitate to ask the experimenter for time for a break should you need one.

D. Benefits of Participation:

Your participation will help to further our efforts to understand how photos of faces impact our ability to perceive stimuli presented immediately afterwards. Understanding how the

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Approval - 12/10/2015
End Date - 12/8/2016
Expedited
Original - 12/10/2015

expressions of others influence our vision is important to understanding the ways that we think about others during our social experiences. Once the experiment is complete, we would be happy to share the results with you.

E. Confidentiality of Your Responses:

During this study, you will be asked for some personal information (name, age, gender, etc.). This information will be confidential and will only be used by the experimenter. The data that is collected about you will be kept private. To protect your privacy, your records will be kept under a code number rather than by name. Your records will be kept in locked files and only study staff will be allowed to look at them. We are only interested in group information. The reporting of the experimental results will only contain group mean results and will contain NO personal information about individual participants, including performance during the experiment. Your name and any other fact that might point to you will not appear when results of this study are presented or published. To make sure that this research is being carried out in the proper way, the Western Kentucky University Human Subjects Review Board will review study records.

F. Compensation for Participation:

You will receive one Study Board credit for each 15 minutes of participation if you are a student at WKU.

G. Refusal/Withdrawal:

Refusal to participate in this study will have no effect on any future services that you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time and with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

Participant signature: ______________________________ Date: ___ /___ /___

Signature of witness: ______________________________

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
THE WESTERN KENTUCKY UNIVERSITY INSTITUTIONAL REVIEW BOARD
Paul Mooney, Human Protections Administrator
TELEPHONE: (270) 745-2129

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Approval - 12/10/2015
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Expedited
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