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Global-happy and Local-Sad: Perceptual Processing affects Emotion Identification

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Abstract

Recent studies have shown that exposure to happy emotional stimuli leads to global, distributed attention, whereas exposure to sad emotional stimuli leads to focused attention. The present study investigated whether the link between perceptual focus and emotion is bidirectional, by examining how global versus local attentional focus affects emotion identification. In an experimental study, emotional faces (sad or happy) were preceded by either a global or local perceptual identification task. The results showed that global focus facilitates identification of happy faces and local focus facilitates identification of sad faces. These findings support a bidirectional relationship between emotion identification and global-local processing.

Key words: emotions; perception; global-local processing, emotion identification, scope of attention

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Introduction

Emotional information plays a crucial role in behavior and is endowed with a privileged status in visual information processing. Recent research has shown that emotions interact with attention and affect perceptual processing (Duncan & Barrett, 2007; Fenske & Eastwood, 2003; Fenske & Raymond, 2006; Mack & Rock, 1998; Phelps, Ling & Carrasco, 2006; Srinivasan & Gupta, submitted; Srivastava & Srinivasan, 2008; Storbeck & Clore, 2007). Fenske and Eastwood (2003) used a flanker task in which a happy or sad schematic face at the centre flanked by happy or sad faces had to be identified. They found sad flankers interfered with the identification of a schematic happy face but not vice versa suggesting that the sad face is associated with narrow scope of attention. Phelps, Ling & Carrasco (2006) showed that emotion facilitates early visual processing with increased contrast sensitivity at threshold for stimuli preceded by a fearful face compared to a neutral face and this effect was magnified with transient covert attention.

An important aspect of perception is the way we perceive wholes (forest) and parts of an object (trees) that can be thought in terms of global and local levels of processing (Navon, 1977; Robertson et al., 1993). Recent research has studied how mood and personality traits may influence global versus local focus. A particular way global-local focus has been studied is through the use of hierarchical stimuli in which a large letter/shape/digit is made up of small letters/shapes/digits (Navon, 1977; Robertson et al., 1993). Such stimuli have been used to investigate the effect of mood or personality traits on global-local focus. For example, people experiencing positive emotions were found to

have a tendency to choose the global configuration more than a local configuration compared to those experiencing negative or neutral emotional states suggesting a broadened pattern of thinking or distributed attention due to positive emotions (Frederickson & Branigan, 2005; Gasper & Clore, 2002).

Neurobiological research suggests that emotions and cognition exert a mutual influence on each other (Duncan & Barrett, 2007; Storbeck & Clore, 2007). Consequently, the link between perceptual focus and emotion may be bidirectional, such that emotion modulates perceptual focus, and in turn, perceptual focus modulates emotion. While a number of studies discussed so far have demonstrated effects of emotions and mood on perception and attention, there are very few studies on the effects of perception or attention on emotion. Nevertheless, there are various considerations that are compatible with the existence of such a bidirectional link.

First, bidirectional associations have been observed for other aspects of emotion processing, in particular, for approach-avoidance behavior and positive versus negative evaluation (Neumann, Förster, & Strack, 2003). Approach behavior is associated with positive evaluation and avoidance behavior is associated with negative evaluation. Approach responses are more easily produced with positive stimuli and avoidance responses are more easily produced with negative stimuli. In addition, producing behavior, (e.g., arm flexion and arm extension) appropriate for approach or avoidance responses resulted in enhancement in happy or sad emotions respectively. Approach and avoidance behavior have also been linked to differences is the scope of perceptual attention (Förster et al., 2006). The mere enactment of approach behavior resulted in better performance with global processing due to the broadening of the scope of attention.

In contrast, enactment of avoidance behavior resulted in better performance with local processing due to the narrowing of the scope of attention. If the link between behavior and evaluative processing is bidirectional, then perhaps the link between perceptual focus and emotion processing can similarly operate in both directions.

Second, reciprocal relationships have been observed between regulatory focus and processing styles, more specifically global and local processing (Förster & Higgins, 2005). Promotion focus is linked to global processing and prevention focus is linked to local processing. Participants performed a global or local task with hierarchical stimuli (Navon, 1977) and later were made to choose between two objects (Experiment 2 in Förster & Higgins, 2005). Participants who performed a global task assigned a larger price than those who performed a local task. The study demonstrates the role of perceptual processing styles on evaluative processes.

So far, there is no direct research evidence linking specific levels of perceptual processing with emotion identification. Macrae & Lewis (2002) found an effect of processing styles on face recognition with global processing associated with better face recognition. However, they did not manipulate emotional content and no study has directly linked differences in perceptual processing to identification of different emotions. In the present study, we investigated the interaction between perceptual processing and emotions using a global-local paradigm (Navon, 1977). We hypothesized that similar to the effects shown with different moods (Frederickson & Branigan, 2005), different behavioral strategies (Neumann, Förster, & Strack, 2003), or regulatory focus (Förster & Higgins, 2005), different levels of perceptual processing (global or local) would interact with identification of specific facial expressions. The objective of the

experiment was to observe any potential priming effects of global-local form processing on subsequent emotion identification. It was expected that when individuals attend to the global aspect of the hierarchical stimulus, they would be faster in recognizing a happy expression. Similarly, when individuals attend to the local aspect of the hierarchical stimulus, they would be faster in recognizing a sad expression.

Method

Participants

Twenty five student volunteers from University of Allahabad participated in the experiment (mean age = 22 years). All participants had normal or corrected to normal vision and were naive to the purpose of the study.

Apparatus and Stimuli

Stimulus presentation and data collection was performed using a commercially available software, DirectRT (Empirisoft Corp., USA) running on a desktop PC with a 17" monitor. We used a total of twenty faces with ten happy and ten sad faces in the experiment. The data set contained equal number of male and female faces in each category. The faces were picked from a database of 163 photographs of Indian adults, which were shown randomly to ten (5 male and 5 female) participants who subsequently did not participate in the experiment. These participants rated the faces on a 7-point likert scale with 1 corresponding to very sad faces, 7 corresponding to very happy faces, and 4 corresponding to neutral faces. Mean rating for the target happy faces and sad faces used in the experiment was 6.2 and 1.9 respectively. All extraneous features were removed by

using an oval frame around the face. The size of the faces (See Figure 1 for exemplar faces) was 7.4° X 10.11°. Four hierarchical global-local stimuli were used in the experiment (See Figure 2). The targets were digits 6 or 9 presented at either at the global or local level with 8 as the distractor. The global targets were made up of local 8s and the local targets constituted a global 8 resulting in four global-local stimuli shown in Fig. 2. The size of the global digit was 3.05° X 4.28° and size of a local digit was 0.47° X 0.85°.

Insert Figures 1 & 2 here

Procedure

Observers viewed the display binocularly at a distance of 60 cm from the monitor. On each trial, a fixation point was presented for 500 ms followed by a global-local target stimulus for 200 ms (see Figure 3). This was followed by a blank display for 100 ms and an emotional face (happy or sad) was presented for 200 ms at the centre. Attention was directed to a particular level by requiring them to detect a target that appeared either at the global and local level in the initial global-local stimulus. Participants made two responses. After the emotional face stimulus, participants made a speeded response to the emotion (happy or sad). Followed by the speeded response, they made a response regarding the target digits (6 or 9) that appeared either at the local or global level in the preceding global-local stimulus. The experimental block consisted of a total of 160 trials preceded by a practice block with 16 trials. Both responses were made using the key

board. Both RT and accuracy was measured for emotion identification and only accuracy was measured for the response with hierarchical global-local stimuli.

Insert Figure 3 here

Results

Data from two participants were removed due to high error rates. Overall accuracy for emotion identification was 93.8% and global-local target identification was 90.5%. Both global and local target accuracies were similar indicating that there was no difference in processing difficulty between the two processing levels. The accuracy for the global-local task was not affected by the emotional face that followed the global-local stimuli. There was no difference in accuracy for emotion identification as a function of emotion or level of processing (global or local). Mean RTs greater than three standard deviations were removed and only RTs for emotion identification in which both responses were correct were used for further analysis. A repeated measures ANOVA with 2 (emotions: happy, sad) x 2 (level of processing: global, local) factors was performed on RTs to identify the emotional expression. The main effect of emotion and level of processing was not significant. The interaction between emotion and level of processing was found to be significant, $F(1, 22) = 6.614$, $MSE = 5135.12$, $p < 0.05$. Results showed an asymmetric effect of prior global-local form processing on subsequent emotion identification. Planned comparisons indicated a significant difference in identifying happy facial expressions preceded by a global target compared to a local target, $F(1, 22) = 2.988$, $p < 0.05$. Happy facial expressions preceded by a global target were identified faster than a

local target. The difference in performance with sad facial expressions preceded by a global target compared to the local target was close to significance, $F(1, 22) = 2.156$, $p = 0.14$.

Insert Figure 4 here

Discussion

Consistent with expectations, processing a global target resulted in faster identification of happy faces compared to a local target. This finding supports the earlier findings linking positive emotion and global processing (Frederickson, 2001; Frederickson & Branigan, 2005; Gasper & Clore, 2002). Processing a local target did not result in a significant benefit for sad faces compared to the local faces but the trend was consistent with a potential link between local processing and negative emotions. These findings support reciprocal interactions between emotion and cognition and more specifically emotion and perception. Not only emotions influence perception but perception also influences emotions. Our results also indicate that not only emotional states or mood affect perceptual processing, but perceptual processing also affects emotion identification. It is to be noted that most studies on emotion and attention has shown that emotions do affect global or local processing but to the best of our knowledge, this is the first study that has shown a reverse effect in which global-local processing affects emotion identification.

There is a great deal of evidence that the efficiency with which global and local level forms are analyzed is modulated by attention, more specifically the spatial size of the attended region (Robertson, Egly, Lamb, & Kerth, 1993). Spatial selection resulting

in a larger attended area may result in facilitation of global processing and selection of a smaller area may result in facilitation of local processing (Robertson et al., 1993). Results show that global processing may result in the widening of attentional spotlight or distributed attention leading to facilitation of processing happy faces. Similarly, local processing result in narrowing of attentional spotlight and focused attention facilitating the identification of sad faces.

Consistent with our findings in the current study, narrow scope and broad scope of attention has been shown to result in better memory for sad faces and happy faces respectively (Srinivasan & Gupta, submitted). Using a primary task in which load was manipulated, happy distractor faces irrelevant to the primary task were remembered better than sad distractor faces under conditions of broad scope of attention. Sad distractor faces were remembered better only under conditions of narrow scope of attention. These results indicate that distributed or broad scope of attention leads to better processing of happy faces and focused or narrow scope of attention leads to better processing of sad faces.

The results are consistent with previous findings with emotion or mood studies indicating the broadening of attention due to happy emotions or mood and narrowing of attention due to negative emotions or mood (Derryberry & Tucker, 1994; Fredrickson, 2001, 2003; Gasper, 2004; Gasper & Clore, 2002; Wadlinger & Isaacowitz, 2006; Yovel, Revelle, & Mineka, 2005). For example, Fredrickson and Branigan (2005) found that an individual in a positive emotional state showed a tendency to choose the global configuration over the local configuration but did not find a significant local bias with negative emotional states. Our results of global or local processing affecting emotion

identification clearly establish a direct link between specific emotions and level of processing. This link is possibly mediated through changes in the scope of attention with distributed or broad scope of attention linked to global processing and happy emotions and focused or narrow scope of attention linked to local processing and sad emotions.

The changes in the perceptual focus of attention are bidirectionally linked to differences behavioral strategies or regulatory focus (Förster & Higgins, 2005; Neumann, Förster, & Strack, 2003). More specifically approach behavior is linked to positive evaluation and avoidance behavior is linked to negative evaluation. Such approach or avoidance behavior has been shown to affect the scope of perceptual attention (Förster et al., 2006). The results of the current study indicate that changing the scope of attention associated with different perceptual styles or levels of processing would result in corresponding changes in evaluation as well as changes in approach or avoidance behavior. Our results are consistent with findings indicating that global processing is associated with promotional focus and local processing is associated with prevention focus (Förster & Higgins, 2005). It is to be noted that the current study focuses on short-term priming effects induced by global or local processing and further experiments would be needed to understand the long-term changes due to the use of processing strategies that manipulate the scope of perceptual attention (e.g., meditation).

The results clearly demonstrate that emotional information processing and hierarchical processing (global-local) *reciprocally* interact with each other. A possible explanation is that early visual processing of different emotional expressions and different levels are mediated by different spatial frequency mechanisms. Spatial frequency mechanisms refer to periodic changes in luminance across space that

characterize information present in images and are typically expressed in terms of cycles per degree. Studies have shown differences in performance with emotional faces as a function of different spatial frequency content (Vuilleumier, Armony, Driver, & Dolan, 2003). Kumar and Srinivasan (submitted) found that sad faces containing only high spatial frequencies are detected faster compared to the happy faces containing high spatial frequencies. In contrast, happy faces containing only low spatial frequencies are detected faster than sad faces containing only low spatial frequencies.

It has also been argued that global processing is mediated by low spatial frequency and local processing is mediated by high spatial frequency mechanisms (Badcock, Whitworth, Badcock & Lovegrove, 1990; Lamb & Yund, 1993). Given the connection between global processing and happy faces with low spatial frequency processing as well as local processing and sad faces with high spatial frequency processing, it is possible that the priming effects due to global-local processing or different scopes of attention on specific emotions are due to the shared spatial frequency mechanisms in visual information processing. We are currently exploring the potential role of spatial frequency information in explaining the interaction between different emotional expressions and hierarchical processing as well as the differences in scope of attention.

In conclusion, this study builds on the view that emotional and perceptual processing interacts reciprocally. Our results indicate that global processing and broad perceptual focus of attention, is associated with happy emotions and local processing and narrow perceptual focus of attention, is associated with sad emotions. These relationships are important in understanding the bidirectional links between different behavioral

strategies and perceptual focus of attention. Further experiments are required to understand the common mechanisms underlying such reciprocal relationships.

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List of Figures

Figure 1

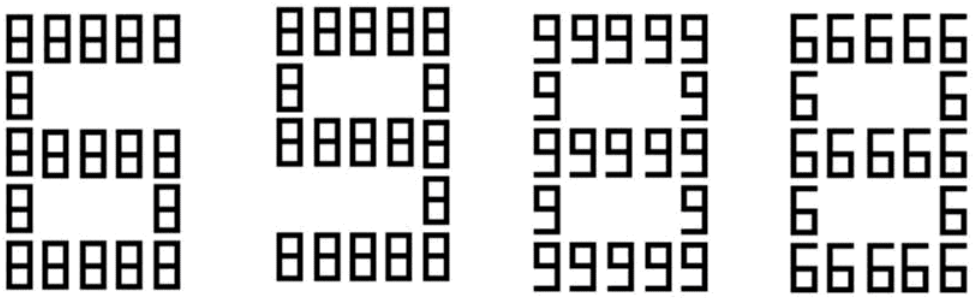

Figure 2

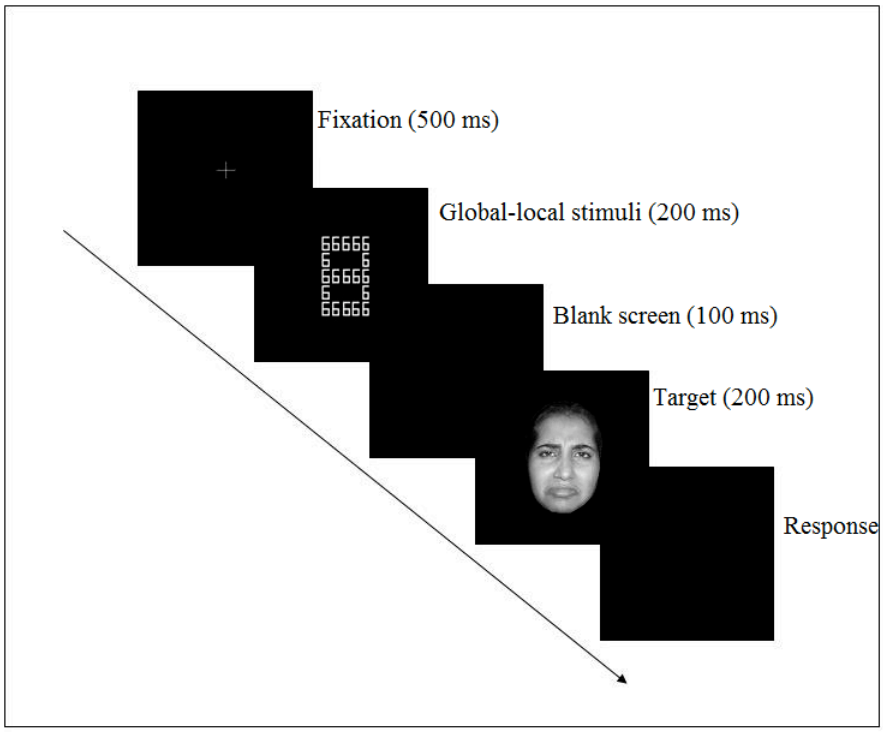
Fixation (500 ms)
Global-local stimuli (200 ms)
Blank screen (100 ms)
Target (200 ms)
Response

Figure 3

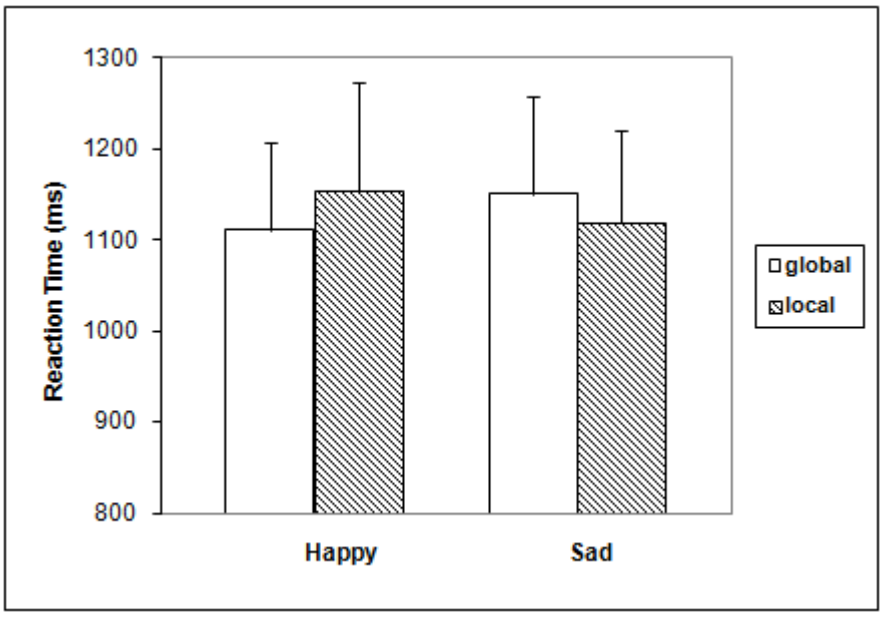
1300
1200
1100
1000
900
800
Reaction Time (ms)
Happy
Sad
global
local

Figure 4