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Changes in Emotion Drive Perceptual Level Shifts: Global vs. Local Processing

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Changes in Emotion Drive Perceptual Level Shifts: Global vs. Local Processing

by

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Each person whose signature appears below certifies that this thesis in his/her opinion is adequate, in scope and quality, as a thesis for the degree Doctor of Philosophy.

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ABBREVIATIONS

IAPS	International Affective Picture System (IAPS)
$GLOMO^{sys}$	Global and Local Processing Model

ABSTRACT OF THE THESIS

Changes in Emotion Drive Perceptual Level Shifts: Global vs.
Local Processing

by

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Different emotional states have been implicated in bringing about specific changes in attention, with positive emotions globalizing attention and negative emotions localizing attention (Fredrickson, 2004). Biases in attentional processes have been associated with the development and maintenance of emotional disorders, anxiety being the most common. Previous studies have shown that anxious individuals present with a bias toward negative information and more readily employ localized attentional processes (Macleod, 2002). This finding demonstrated a link between perceptual levels of attention with higher order conceptual attention, which in turn influences emotional states. Many researchers have explored this relationship, including Fredrickson (2004), who developed the Broaden-and-Build hypothesis, demonstrating how positive mood broadens attentional, increases thought-action repertoires and creativity. However, other studies have presented different findings, with positive emotion allowing for both global and local attentional scopes (Baumann & Kuhl, 2002). The main aim of the study was to demonstrate how specific emotions, specifically fear and amusement, bring about perceptual level shifts in attention (global vs. local). The primary hypothesis is that fear

will lead to more localized perceptual attention and that positive emotions like amusement will lead to more globalized perceptual attention.

CHAPTER ONE

INTRODUCTION

Attentional processes have been implicated as major players in the maintenance and etiology of anxiety disorders. However, anxiety is a term that has been vastly overused but remains almost universally elusive and hard to define. Many researchers have offered definitions to help understand to phenomenon of anxiety. Damasio (1999) defines anxiety by a person's conscious and unconscious physical symptoms, and differentiates fear responses from those of anxiety. He stated that the experience of fear consists of the unconscious detection of threat, and the emotion of fear refers to the unconscious activation of the body by somatic and autonomic nervous systems. These systems create the symptoms of the pounding heart and sweating palms. The feeling of anxiety refers to the conscious awareness of these bodily sensations (Damasio, 1999).

Other researchers speak of fear as the immediate alarm reaction to present threat, which is characterized by the impulse to flee due to sympathetic arousal (Barlow et al., 1996). Anxiety has been defined as a future-oriented emotion characterized by negative affect and biased attention toward potential threats, which then leads to hypervigilance and muscle tension (Macleod et al., 2002). In summary, fear mobilizes the body for action, while anxiety brings about a state of somatic and environmental scanning for threat.

Clinically, anxious individuals excessive autonomic nervous system activation, which is highly adaptive when reacting to real environmental threats, but can be distressing when they are activated in response to ordinary life stressors. Eldar et al. (2010) suggested that anxiety is associated with a specific neural fear circuitry that projects from the primary visual cortex to the amygdala and other limbic regions (areas implicated in emotional processing in the brain) and bypasses the frontal regions. This suggests that the short and rapid neural pathways to the visual thalamus are responsible for the fast and crude processing of visual threats. Furthermore, researchers have suggested that fear and anxiety represent qualitatively distinct emotional states, according to animal studies. These findings suggest that the neural circuits mediating fear may be distinct from those at play for those with clinical or subclinical levels of anxiety. (see Rhudy & Meagher, 2000).

Overall, anxious and fearful states are both likely to be associated with a narrowing of attentional scope, while more positive emotions have been shown to do the opposite, broaden attentional scope (Fredrickson & Branigan, 2005). Furthermore, research suggests a bidirectional causal flow between cognitive attention and emotional processing. However, research findings have not been consistent, as will be discussed further in this paper.

Attention: Global vs. Local

Generally, people perceive the world in terms of either the whole or its parts (Tan, Jones, Watson, 2009). On a perceptual level, global processing involves perceiving an item's overall configuration, while local processing breaks the item down into its component parts. However, there have been multiple definitions and explanations of global and local processing, as well as confusion concerning the level of processing being referred to in different studies. Our perspective on global/local visual perception and higher order attention is primarily based on the hypothesis suggested by Fishbach, Freidman, Forster, and Werth (2003). In accordance with this hypothesis, the attentional mechanisms employed for broadening or narrowing visual perception are correlated with those employed for attending differentially to higher order conceptual thinking (see Freidman et al., 2003). Therefore, broadening and narrowing attention occurs through similar mechanisms, by impacting perceptual content and/or internal conceptual content. Furthermore, broadening or narrowing visual perception of the external world can lead to a broadening or narrowing, respectively, of the internal conceptual world, such as working memory. For instance, visual perception can be manipulated to attend broadly or narrowly on an external stimulus. When presented with a semantic construct such as “bird” or “automobile”, a person’s associate and make creative associations about these constructs will be more extensive if the initial perceptual focus of attention was broad as opposed to narrow (Friedman et al., 2003).

More recent studies refer to the broadening and narrowing of attention as globalizing and localizing, respectively. Therefore, these constructs will be referred to as global and local attention in the current study. This was done to ensure comparability among studies (Huntsinger, Clore, & Bar-Anan, 2010; Macleod et al, 2002; Bocanegra & Zeelenberg, 2011; Tan, Jones, & Watson, 2009). The goal of the study is to further establish this link with more reliable emotional induction and precise attentional processing measures. Furthermore, we will explore how global/local processing is impacted at a visual and conceptual level by different emotions, as opposed to a general stressful state.

CHAPTER TWO

LITERATURE REVIEW

From Vision to Cognition: Global and Local Attention

Globalized and localized attention were defined for this study at both visual (early pre-awareness perceptual process) and cognitive (higher attentional process) levels. Processing at a visual level will be termed *global and local perception*. Processing at the conceptual level will be termed *global and local attentional awareness.*

Visually, a global perspective entails the perception of an entire visual scene and its details by focusing on the larger gestalt (Tan et al., 2009). This type of processing takes longer since it sacrifices speeded perception to explore various aspects of a particular scene and uses different details to construct an accurate whole (Tan et al., 2009). On the other hand, localized vision is goal-oriented, usually toward detecting threat. Therefore, it processes stimuli faster but sacrifices detail and accuracy, usually focusing on one aspect of the scene instead of making associations between different areas (Huntsinger, Clore, Bar-Anan, 2010).

Globalized Attentional Processing

A globalized state of attention processing is defined as a detailed analysis that takes into account all the information provided without narrowing attention toward threatening expectations. This is a more flexible cognitive state, where thinking is clear and free to associate with new incoming information (Huntsinger et al., 2010). It occurs when a person’s thoughts are not constrained and are free of judgment. In other words, when faced with a problem, a globalized attentional processing is a state that allows for flexibility and creativity when searching for solutions. For example, behaviorally, a person with a globalized scope of attentional processing enters a new social situation/relationship without bringing in expectations and fears from previous bad relationships.

Localized Attentional Processing

A localized state of attentional processing is defined as a less flexible state of analysis, with more emphasis on certain specific details, usually those that are judged to be negative or threatening. Localized attentional processing is often associated with a particular affective or cognitive state. (Gable & Harmon-Jones, 2012). For example, worrying incessantly about a certain life situation or ruminating over previous experiences represents a local attentional awareness. It is a narrowing of thoughts and rigidity in terms of searching for rational solutions to problems. This occurs most severely in panic or anxiety states, where executive functions such as formulating logical plans are disturbed by incessant worries and stress, which act to put the body on high alert for either a fight or a flight response (Gable & Harmon-Jones, 2010). Therefore, if a person is consumed by thoughts about a negative event, all attentional resources are focused on that one subject area. Aversive stimuli have been demonstrated by many studies to cause organisms to "zero-in", thus increasing attentional focus and sending cognitive resources to deal with the potential threat. This process increases an organism's ability to react to the object of attention (Gable & Harmon-Jones, 2012).

Attention and Specific Emotions

Different discrete emotions have been shown to have differential effects on attentional processes (Bocanegra et al., 2011; Hunstinger et al., 2010). Fear is one of the discrete emotions that has been explored extensively in the literature due to its strong biological substrates and its role in many prominent disorders, such as anxiety disorders. Macleod (1986) explored the attentional biases that accompany fear using the dot-probe task, which demonstrated anxious individuals attend fastest to threatening and negative stimuli. Overall, the anxious participants attended more closely to the stimuli following directly after the threatening words than stimuli following neutral or positive words.

A more recent study replicated the findings of Macleod (1986) using emotional faces instead of words. Eldar et al. (2010) found that anxious participants were biased toward the threatening faces, in that they responded faster to probes appearing in the same location following threatening faces. However, both anxious and non-anxious participants made more errors at the appearance of a threatening face, demonstrating the body's automatic survival response in which threat takes precedence over task accuracy (Eldar et al., 2010).

It has also been found that happy stimuli generally evoke slower and more detailed visual analysis, compared to fearful stimuli that undergo coarser, yet faster analysis (see Bocanegra & Zeelenberg, 2011). These speeded responses bypass the analytical areas of the brain that participate in positive emotion, and go straight to the amygdala to alert the organism to escape from the threat or stressor (Bocanegra & Zeelenberg, 2011). This has been demonstrated by studies showing tradeoffs in spatial and temporal visual processing depending upon the emotion elicited by specific situations

(Bocanegra & Zeelenberg, 2011). Therefore, fear signals a potential threat, so the brain reacts quickly to ensure survival while also localizing attentional awareness to stimuli closely related to the stressor.

In summary, the global perspective is associated with positivity and a peaceful state of mind, where thoughts run freely and are not tied strongly to any one topic or concern, as in the localized perspective (Tan et al., 2009). A global attentional awareness coincides with the popular notion of "La Vie en Rose" (life through rose colored lenses), while localized attentional awareness takes on the characteristics of what is popularly referred to as "tunnel vision." These two popular sayings, like global and local attentional awareness, take on double meanings, referencing the visual phenomenon as well as the cognitive/emotional experience. Globalized Attentional Awareness (La Vie en Rose) is associated with broadened visual scope and positive emotion and attention while Localized Attentional Awareness (Tunnel Vision) is associated with narrowed visual scope and negative emotion and attention.

Emotion and Perception

An important factor for understanding normal perception is the circumstances that elicit global or local perceptual processing. Navon (1977) proposed that in normal individuals, global perceptual processing takes precedence over local. This was demonstrated by what has become known as the Navon task, where participants were presented with large letters made up of smaller letters (that is, a large L made up of smaller H's). Navon found the global letters (large L) to be identified faster than the small letters (small H’s). Navon found the global letters (large L) to be identified faster than the small letters (small H’s).

Although this finding has been replicated by multiple studies (Derryberry et al., 1998), many factors, such as emotional state, can reverse global superiority in processing. Emotion influences perception 2009). This can include many facets of perception, from color and brightness to attentional selection of which object to attend to (Anderson, 2005).

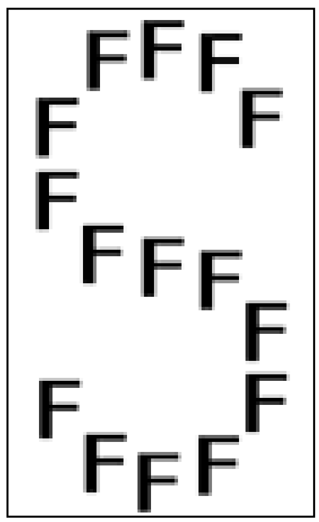

Figure 1. Sample Navon task figure.

Though this finding has been replicated by multiple studies (Derryberry et al., 1998), many factors, such as emotional state, can reverse global superiority in processing. Emotion influences perception at differing stages of visual processing (Bocanegra & Zeelenberg, 2009). This can include many facets of perception, from color and brightness to attentional selection of which object to attend to (Anderson, 2005). The neurophysiological data, particularly functional magnetic resonance imaging (fMRI) studies, have shown that emotion itself can boost activity in the visual cortex of the brain (Lang et al., 1998). The amygdala has projections to all levels of the ventral visual stream, which means that emotions such as fear automatically activate the amygdala, which in turn modulates the processes of the visual cortex. (Amaral, Behniea, & Kelly, 2003; Vuilleumier, 2005). Therefore, there is evidence for emotion and visual processing being linked, such that emotions influence how we attend to specific types of stimuli.

Anxiety has been shown to reduce global, bigger picture processing, leading to faster and more biased processing of threatening and emotionally negative information. Easterbrook (1959) described this phenomenon at a higher level of processing as a conceptual focusing, or narrowing, which impairs the ability to make new associations and experience creative processes. This narrowing of cognition is demonstrated in the tightly structured thought patterns in patients with obsessive-compulsive disorder Easterbrook, 1959). Easterbrook (1959) also asserted that positive emotions do the exact opposite, broaden attention, while negative emotions decrease processing of peripheral visual stimuli. Although many studies show support for positive emotion leading to more globalized attention, current studies have been mixed in terms of how emotion impacts attentional processes.

Emotion Induction

Previous studies have uncovered the impact of specific emotions on attentional scope (Bocanegra & Zeelenberg, 2011; Huntsinger, Clore, & Bar-Anan, 2010; Macleod et al, 2002; Tan, Jones, & Watson, 2009). Different emotion induction strategies have been employed by studies to demonstrate how emotion impacts attention in a controlled setting. To further demonstrate the effect of emotion induction on actual perception, a study conducted by Matthews and Harley (1996) used the emotional Stroop task, with emotionally provocative words and neutral words to assess for color naming delays. The findings revealed that anxious individuals were slower to name the colors of words that were negative and threatening, and hence were less able to ignore the negative information in order to complete the task. This demonstrated a conceptual localization, where the attentional bias at a semantic/cognitive level interfered with the task at the more initial visual processing level. This same interference effect has been replicated in a wide range of anxiety disorders and in non-clinical populations (Mathews & Harley, 1996). Additionally, it was found that even when the anxiety provoking words were masked, they were still processed on a pre-awareness level, causing the same interference effect.

In the current study, we employed two methods because of they have been normed across hundreds of participants on their emotional valence and arousal. We used still images from the International Affective Picture System (IAPS) to induce positive and negative emotional states as well as for the neutral control condition (Center for the Study of Emotion and Attention [CSEA-NIMH], 1999). The IAPS provides normative ratings of emotion (arousal, valence and dominance) for a set of color photographs that evoke a set of normative emotional reactions.

We also used film clips. Fredrickson and Branigan (2005) used film clips to induce specific positive, negative, and neutral emotional states. They found that following the amusing video clips, participants identified more global Navon task targets then when negative or neutral video clips were shown (Fredrickson and Branigan, 2005). The use of video clips has gained momentum in recent years due to their dynamic nature and ecological validity, putting the viewer into an artificial model of reality where strong emotions can be elicited (see Schaefer, Nils, Sanchez, & Philippot, 2010). Multiple studies have demonstrated the strong impact of *film clips* on inducing positive and negative mood states, and reliable sets of film-clip stimuli for the elicitation of discrete emotional states have been developed. Most recently, Schaefer and colleagues (2010) developed a set of film-clip stimuli that are validated in their ability to produce specific emotions. These stimuli will be employed in the current study.

Attention Modification for Anxiety Treatment

The relationship between emotion and attention – both visual and cognitive – has broad implications for extending the current theoretical understanding of the mind and therapeutic practices for the treatment of various emotional disorders. This relationship between attention and emotion can potentially be manipulated to attend to certain thoughts and emotions over others through visual attention training (Macleod et al., 2002).

Macleod (2002) conducted a study examining the potential role of attention in treating anxiety. The dot-probe task was modified to decrease attentional biases away from threatening stimuli toward neutral, by continuously designing the target probe to appear after the neutral words. After eight weeks, there was a decrease in self-reported anxiety (Macleod, 2002). These findings show that a brief period of attention modification training could bring about noticeable reductions in self-reported anxiety without any therapy sessions. However, not enough studies have been done to assess if the effects would generalize to real life situations. More research is needed to evaluate attentional modification as primary therapy or an adjuvant to it. Attention modification software could potentially lead to retraining attentional systems in order to alleviate anxiety symptoms, both clinically and sub-clinically. Using globalized and localized attentional systems could potentially serve as a more powerful exercise for redirecting attention and impacting emotional processing.

Currently, effective treatment strategies for alleviating anxiety symptoms have core attention modification features. Specifically, mindfulness-based relaxation therapy has attained empirical support for treating anxiety as well as other mental illnesses (Baer et al., 2003). Multiple studies have found evidence for the positive effect of mindfulness on GAD. Mindfulness was defined by Baer et al. (2003) as an exercise in using broader observations of one's own present moment-to-moment experience of physical sensations, thoughts and feelings. Mindfulness training teaches acceptance of these thoughts and letting go by keeping the bigger picture (globalized attentional processing) in mind. Research has supported the beneficial aspects of mindfulness training and has found it to be associated with reduced Stroop interference, as well as less vulnerability to unexpected events and worry (Anderson, Lau, Segal, & Bishop, 2007). In essence, mindfulness allows the individual to distribute attention and not focus judgmentally on any one event or stimulus. Studies have also revealed that those trained with mindfulness perform better on tasks that require more globalized attention processing (Anderson et al. 2007).

Three Current Theories of Emotion and Attention

Multiple hypotheses have been formulated to account for the impact of emotion on attention. The *Broaden and Build Hypothesis* asserts that positive emotions broaden perspective and increase thought action repertoires, which in turn lead to increased levels of creativity, while negative emotions narrow perspective and bring about a conceptual focus in order to deal with dangers or other specific circumstances (Fredrickson, 1998, 2001). For example, Wadlinger and Isaacowitz (2006) used eye-tracking technology to demonstrate the Broaden and Build hypothesis, showing the effect of emotion on visual perceptual scope. Participants in positive moods had increased attention toward peripheral images (if the images were not negative) when shown emotionally neutral visual scenes when compared to participants in neutral moods. Therefore, this theory accounts for both the changes on a perceptual level and conceptual level of processing, demonstrating that specific emotions can bring about conceptual shifts in attention which are mirrored on the perceptual processing levels, impacting visual attention.

Additionally, the *flexibility hypothesis* of emotions' impact on global/local processing asserts that positive emotions allow attention to shift more readily between global and local, depending upon the necessity of processing in specific situations or circumstances (Baumann & Kuhl, 2005). Baumann and Kuhl (2005) induced mood with the use of participant-specific emotional words as primes for positive or negative states. For the task itself, participants were shown large shapes comprising smaller shapes (that is, a large triangle made up of small circles). Reaction times for detecting the target shape (e.g. the circle) were measured. Positive word primes led to faster identification of the local targets and negative word primes inhibited local processing. Baumann and Kuhl

(2005) suggested that happier moods allow individuals to overcome biases in attention and foster cognitive flexibility instead of leading to a particular attentional process (see also Tan et al., 2009). These results directly oppose previous studies, which found attention became globalized after participants were exposed to a positive emotional prime (Basso et al., 1996; Derryberry & Reed, 1998; Fredrickson, 2004; Gaspar & Clore, 2002). This apparent contradiction, however, may be due to the lack of specificity in the types of emotions being induced in the priming tasks. Therefore, the flexibility hypothesis asserts that a conceptual globalizing, brought about by positive emotion leads to the more successful completion of assigned laboratory tasks, even if that means perceptual localizing, or attending to local stimuli.

The *global and local processing model* ($GLOMO^{sys}$) was most recently proposed by Forster and Dannenberg (2010) as a comprehensive model focused on the cognitive mechanisms elicited by global/local processing styles. This theory posits that there are two separate processing systems, that of the global and local level. When the global system becomes activated, people are able to take in the bigger picture and integrate information more broadly. When the local system if activated, details are more easily perceived and narrow cognitive categories are activated, blocking out incoming information that does not match the specific categories. It has also been demonstrated that global and local processing occurs across modalities. For instance, Forster (2011) found that when participants are primed to listen for the overall meaning of a poem as opposed to its specific details, or attend to all the different tastes of a cereal as opposed to focusing on one flavor, their global visual processing was enhanced as measured via Navon task. In summary, this theory posits that perceptual scope is related to conceptual scope in that a global or local perspective goes on to influence levels of creativity and information processing. The global or local systems are activated through psychological variables. Studies have shown that compared to healthy participants, those with high levels of autism, OCD, and anxiety showed enhanced local processing. Global processing has been shown to be active in novel situations that require exploration, as well as positive mood states. In summary, both psychological processing systems exist and evolved with specific purposes. According to GLOMOsys, global processing integrates while local processing differentiates (Forster, 2012).

Current Study

The goal of the current study is to assess whether or not a relationship exists between perceptual and emotional states. The literature has established a pattern showing that globalized attention is associated with positive and localized attention is associated with negative emotion (Derryberry et al., 1998; Fredrickson, 2004; Fredrickson and Branigan, 2005; Forster & Dannenberg, 2010; Mathews & Harley, 1996). This study will bring together techniques from the literature to assemble measures for assessing the effects of attention on emotion that will demonstrate their dependency on one another. Furthermore, we will also attempt to demonstrate how inducing specific emotional states will lead to particular preferences in terms of visual attention (global or local). Specifically, positive emotions will be induced with the use of amusing film clips and negative emotions will be induced using fearful and threatening video clips. After the positive clips, participants are expected to show a preference for the global stimuli in the Navon task. In contrast, after the negative clips, participants are expected to show a preference for local stimuli in the Navon task. This will demonstrate the impact of emotion on perceiving the big picture (globalized perception) and specific details (localized perception).

Participants will be randomly assigned to conditions because no clinical populations will be assessed; therefore, causality will be applicable. However, measures of anxiety and depression will be administered to assess for differing levels of anxiety and depression and verify the equivalence of the groups. Therefore, the goal of the study is to establish a link between visual and attention levels of global and local processing with emotional processing. We predict that positive emotional elicitation will lead to a globalized attentional awareness, which then equates to a globalized visual perception. Following positive emotion, participants will attend more often to the global level stimuli (Navon Task) compared to when elicited following negative or neutral emotions. We also predict that negative emotional elicitation will lead to a localized attentional awareness, which then equates to a localized visual perception. So, following negative emotion, participants will attend more often to the local level stimuli compared to when a positive or neutral emotion is elicited.

Emotional State Induction

Video film clips and still images from the International Affective Picture System (IAPS) were used to induce positive and negative emotional states as well as for the neutral control condition (Center for the Study of Emotion and Attention [CSEA-NIMH], 1999). The IAPS provides normative ratings of emotion (arousal, valence and dominance) for a set of color photographs that evoke a set of normative emotional reactions. The valence and arousal rating scales were provided for participants to rated how they felt after viewing each image, as well as after viewing each film clip.

Gross and Levinson (1995) evaluated 250 films and selected two that were rated most consistently as evoking each of the seven specific emotion types addressed: amusement, anger, contentment, disgust, fear, sadness, and surprise. About 400 people watched and rated the film clips, and indicated the amount of each emotion they felt. For example, one of the film clips selected as being the most effective at evoking sadness was taken from *The Champ* (Lovell & Zeffirelli, 1975). It is a two-minute scene during which a boy's father dies after being beaten severely in the boxing ring.

Navon Task

The Navon task was used to assess global and local visual attention. Navon (1977) proposed that in normal individuals, global perceptual processing takes precedence over local. This was demonstrated by what has become known as the Navon task, where participants are presented with large letters made up of smaller letters (for example, a large L made up of smaller Hs) (see Figure 1). Navon found the global letters (the large L in this example) to be identified faster than the small letters (the small Hs). The Navon task has been used in multiple studies assessing for global/local attention, and is one of the only reliable and validated instruments for measuring this construct in the literature (Billington, Baron-Cohen, & Bor, 2008; Christesen & Lynn, 2002; Fredrickson and Branigan, 2005). Using the Navon task will facilitate comparisons of our findings with those of previous studies.

Summary of Aims

Establishing a relationship between different emotional and attentional states will increase current knowledge on these topics and help define how specific types of anxiety impact attention, and how anxiety and fear potentially impact attention differently. Also, the current study may help to show how positive emotions impact attention, thus improving our understanding of the process of creativity and how it can potentially be fostered via attentional manipulation the same way that anxiety can potentially be treated.

Hypotheses

(1) The positive emotion induction via film clips and images will lead to an increased preference for and speeded responding toward global level Navon stimuli, and a decrease in local stimuli detection.

(2) The negative emotion induction via film clips and images will lead to an increased preference for and speeded responding toward local level Navon stimuli, and a decrease in global stimuli detection.

(3) Negative IAPS images and films will have faster reaction times for local stimuli as compared to neutral or positive IAPS images and films.

(4) Positive and neutral IAPS images and films will have faster reaction times for global stimuli as compared to negative IAPS images and films.

(5) Films will moderate the relationship and lead to stronger effects such that negative films will have faster reaction times to local stimuli compared to negative IAPS images. Furthermore, positive films will lead to faster reactions times to global stimuli compared to positive IAPS images.

(6) Negative film clips are expected to elicit anxiety, which is predicted to manifest in slowed reaction times compared to negative IAPS images, which are expected to elicit automatic fear, or startle reactions. The negative IAPS images are expected to bring about faster responding to local stimuli since fear is known to quickly prepare the organism to react whereas anxiety brings about a state of scanning and hypervigilance.

CHAPTER THREE

METHOD

Participants

Power analyses indicated that we need a sample size of 44 participants to have an 80% chance of detecting a significant effect. A total of 40 Loma Linda University students were recruited, but 10 were not considered in the final analysis due to inaccurate responses. A total of 30 students were included in the full analysis of the study. Students were recruited via the SONA system, through which they were rewarded extra credit points toward select courses in return for participating in this study. In addition, participants were also provided with $5 Starbucks gift cards for participation. Participants who reported current or past history of any type of anxiety disorder or major depression were excluded from the analyzed data, since current clinical levels of anxiety may confound the results of the study (although they were allowed to participate and receive extra credit). One participant was excluded for meeting criteria for an anxiety disorder.

Procedure

Phase I. All participants provided informed consent before the start of the experiment. Then the Beck Depression and Anxiety inventories were administered. After all the baseline measures were collected, the first phase of the experiment will began.

First, the experimenter provided instructions and described all that would take place during the experiment. The task began with a mood inducing film clip or image from the International Affective Picture System. The six film clips were randomly presented first, followed by the random presentation of the 54 IAPS images. The films clips ranged from 1 to 2 minutes, with two films for each emotion category: positive (humorous/happy), negative (fearful/sad), or neutral. These were presented in a counterbalanced order across participants. The IAPS images were shown for six seconds each on the screen, and were also presented in a counterbalanced order across participants. They were also split into the three emotion categories, with 18 images per emotion type. Additionally, the film clips and IAPS images were selected to have an equal number of high and low arousal level rated stimuli per emotion category in order to account for arousal level. After each film clip and IAPS image, the Navon task was administered. First, a target figure was flashed on the screen, followed by 12 Navon figures, one at a time, to which the participants responded with a yes or no. There were 6 different target figures, one for each film clip shown. For example, if the target figure was an "H," and the Navon figure following was an "H" made up of small "L"s, a "yes" response would signal global level detection of the figure, while a "no" or error response would suggest a focus on the local level. Each Navon figure was flashed on the screen for 500ms, with participants having 2500 ms to select a response before the computer proceeds to the next Navon figure. There was one target figure prompt for each film followed by 12 Navon figures. In each set of Navon figures, four would have targets present on a global dimension, four on a local dimension, and four figures wihtout the target letter (i.e. If target was "A", these figures would be a Navon "T" made up of "B"s). The Navon figures will be randomized for each participant.

Phase II. After all the stimuli are presented and the Navon task portion of the experiment is completed, all the film clips and IAPS images were shown again in random order for the participants to rate each on valence and arousal. Specially, participants were asked to report how they felt upon viewing the stimuli the first time around during Phase 1 of the experiment. The ratings were measured on a 10-point Likert scale, ranging from “pleasant” to “unpleasant” for valence and by “calm” and “excited” for arousal. This portion of the experiment was done to ensure that the participants experienced the predicted emotion for each particular film clip and IAPS image.

Furthermore, participants were then asked to recall the film clips they were shown and provide a brief description of their content and how they felt upon viewing it. This was how the participant’s familiarity with the films was assessed. This also provided an opportunity to explore the feelings the participant experience aside from the two dimensions provided by the rating scale.

Analysis

A 2 x 2 x 3 Repeated Measures ANOVA was conducted for phase 1, assessing for the effects of medium (film clip or IAPS image), valence (positive, negative, or neutral), and attentional scope (global or local) on speed and accuracy of responding. For response frequency, the proportion of trials a participant endorsed a local level of processing was calculated and used as a dependent measure. A-priori hypotheses will be tested using paired sample t-tests. Ten Participants who performed at chance level or below (.50 accuracy) on the Navon task were removed from the analysis.

CHAPTER FOUR

RESULTS

A repeated measures ANOVA was conducted with medium (IAPS and film clips), view (global and local), and valence (negative, neutral, and positive). There was an interaction that was trending toward significance between medium, view, and valence (F [2, 29] = 2.24, $p > .05$, $\eta^2 = .072$) (Table 1). Inspection of Figure 2 suggested that reaction times between view and valence were reversed for *film clips* and *IAPS images*, such that negative *IAPS images* led to faster responding for local stimuli, while negative *films* led to faster responding for global stimuli (see Figure 2).

Table 1.

ANOVE Table of response time.

Independent Variable	*df*	Mean Square	*F*	η^2	Observed Power
Medium	1	280142.87	13.72**	.32	.95
View	1	1185.84	.17	.01	.07
Valence	2	2003.64	.23	.02	.10
MediumXValence	2	18373.55	2.08	.14	.42
MediumXView	2	3850.22	.82	.03	.14
ValenceXView	2	3855.14	.14	.01	.07
MediumXViewXValence	2	6784.96	2.24	.12	.07

*Sig. <0.01***
*Sig.<0.05**

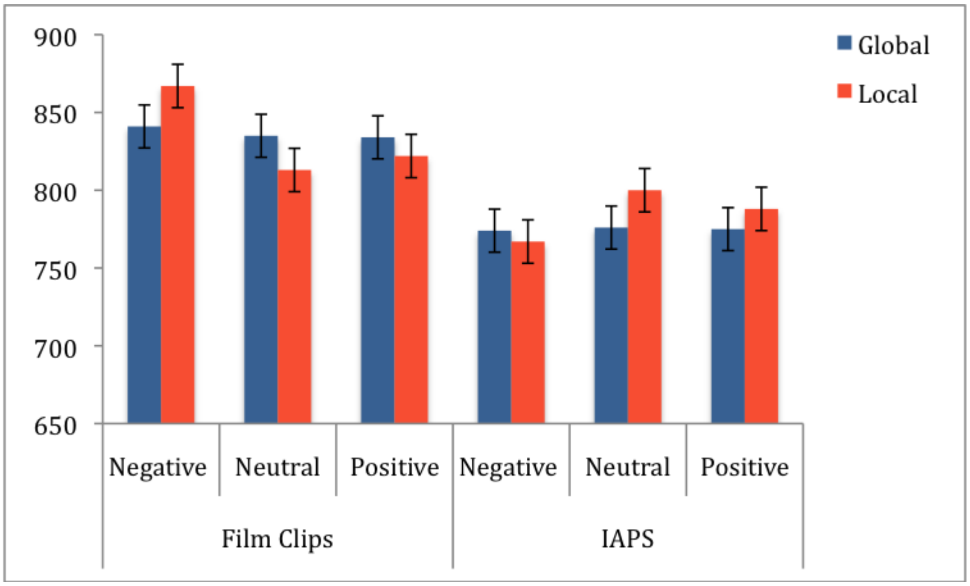

Figure 2. Reaction times on Navon task for IAPS images and film clips.

Predicted differences in reaction times (measured in milliseconds) between medium, view, and valence were also observed. The primary hypothesis was that fear, like anxiety, would lead to more localized perceptual attention and that positive emotions such as amusement would lead to more globalized perceptual attention. Due to the multiple *t*-tests, the Bonferronni correction was applied and indicated that $p < .0025$ was needed for statistical significance to be reached. None of the comparisons reached that level; however, the data is trending in the expected directions. Therefore, we reported the effect size to assess the relationship between the variables since the lack of statistical significance was partly due to a small sample size (see Table 2. 3. 4 & 5).

Table 2.

Pairwise comparisons between global and local levels of processing of IAPS images and Films, with valence kept constant.

Variable	*M*	*SD*	*df*	*t*	*p*	*d*
IAPS Negative Global	774	175				
IAPS Negative Local	767	173	29	.39	.70	.04
IAPS Neutral Global	776	192				
IAPS Neutral Local	800	177	29	2.48	.02	.13
IAPS Positive Global	775	190				
IAPS Positive Local	788	179	29	.76	.46	.07
Films Negative Global	841	203				
Films Negative Local	867	241	29	.98	.34	.12
Films Neutral Global	835	236				
Films Neutral Local	813	223	29	.89	.39	.10
Films Positive Global	834	190				
Films Positive Local	822	166	29	.72	.48	.07

Table 3.

Pairwise comparisons between valence for IAPS images, when view was held constant.

Variable	*M*	*SD*	*df*	*t*	*p*	*d*
IAPS Negative Global	774	175				
IAPS Neutral Global	776	192	29	.16	.87	.01
IAPS Negative Global	774	175				
IAPS Positive Global	775	190	29	.08	.93	.006
IAPS Neutral Global	776	192				
IAPS Positive Global	775	190	29	.08	.94	.005
IAPS Negative Local	767	173				
IAPS Neutral Local	800	177	29	2.58	.02	.19
IAPS Positive Local	788	179				
IAPS Negative Local	767	173	29	1.34	.19	.12
IAPS Neutral Local	800	177				
IAPS Positive Local	788	179	29	.92	.37	.07

As expected, negative IAPS images (*M* = 767, *SD* = 173) led to faster reaction times for local stimuli than neutral images (*M* = 800, *SD* = 177), *t*[29] = 2.6, *p* < .05, *d* = .19 (Table 3). Furthermore, neutral images led to faster reaction times for global stimuli (*M* = 776, *SD* = 192) than local stimuli (*M* = 780, *SD* = 177), t [29] = 2.5, p < .05, *d* = .13. This effect was reversed for films, such that neutral films led to faster reaction times for local stimuli (*M* = 813, *SD* = 223) than negative films (*M* = 867, *SD* = 241), *t* [29] = 2.1, *p* < .05, *d* = .24 (Table 4).

Table 4.

Pairwise comparisons between valence of films, with view held constant.

Variable	*M*	*SD*	*df*	*t*	*p*	*d*
Films Negative Global	841	203				
Films Neutral Global	835	236	29	.23	.82	.04
Films Negative Global	841	203				
Films Positive Global	834	190	29	.29	.78	.04
Films Neutral Global	835	236				
Films Positive Global	834	190	29	.03	.98	.005
Films Negative Local	867	241				
Films Neutral Local	813	223	29	2.13	.04	.24
Films Negative Local	867	241				
Films Positive Local	822	166	29	1.54	.13	.22
Films Neutral Local	813	223				
Films Positive Local	822	166	29	.36	.72	.05

A significant main effect of medium was found between IAPS images and film clips (F [1, 22] = 17.37, p < .001, η^2= .32), such that IAPS images led to faster reaction times compared to film clips overall. No other main effects were found, but the interaction between medium, view, and valence approached significance (see Table 1, 2, 3, 4, and 5). Specifically, negative IAPS images (*M* = 774, *SD* = 175) led to faster reaction times for global stimuli than negative films (*M* = 841, *SD* = 203), *t* [29] = 2.5, *p* <. .05, *d* = .36. Neutral IAPS images (*M* = 776, *SD* = 191) led to faster reaction times for global stimuli compared to neutral video clips (*M* = 835, *SD* = 236), *t* [29] = 3.5, *p* < .01, *d* = .28. Positive IAPS images (*M* = 775, *SD* = 189) led to faster reaction times for global stimuli compared to positive films (M = 834, SD = 189), t [29] = 2.4, $p < .05$, d = .32. Lastly, negative IAPS images (M = 767, SD = 173) led to faster reaction times for local stimuli compared to negative films (M = 867, SD = 241), t [29] = 2.6, $p < .05$, d = .49 (see Table 5). Significant differences were not observed for reaction times to local stimuli for neutral and positive IAPS images and films.

Table 5.

Pairwise comparisons between IAPS and films, with view held constant.

Variable	*M*	*SD*	*df*	*t*	*p*	*d*
IAPS Negative Global	774	175				
Films Negative Global	841	203	29	2.53	.02	.36
IAPS Neutral Global	776	192				
Films Neutral Global	835	236	29	3.46	.002	.28
IAPS Positive Global	775	190				
Films Positive Global	834	190	29	2.38	.03	.32
IAPS Negative Local	767	173				
Films Negative Local	867	241	29	3.47	.002	.49
IAPS Neutral Local	800	177				
Films Neutral Local	813	223	29	.57	.57	.06
IAPS Positive Local	788	179				
Films Positive Local	822	166	29	1.49	.15	.20

For accuracy, the same 2 x 2 x 3 repeated measures ANOVA was conducted. We only found a significant main effect for medium, F [1, 38] = 5.2, $p < .05$. Bonferroni-corrected post-hoc analyses showed that participants responded more accurately following IAPS images than films. There were no significant differences in accuracy based on the view of stimuli or valence although there were some interesting trends (Figure 3).

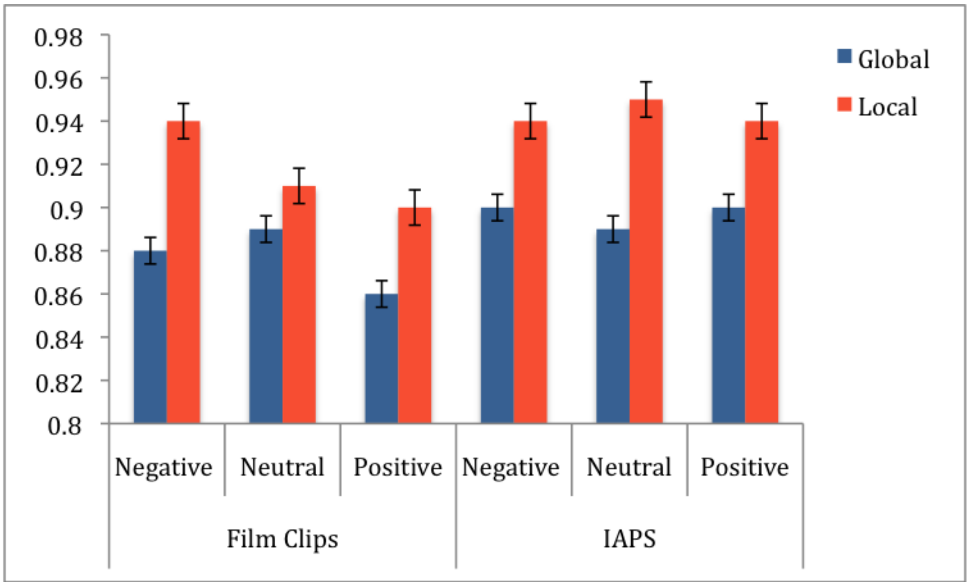

Figure 3. Accuracy of responding to Navon task. Overall trends demonstrate lower accuracy following film clips, regardless of view and valence.

The self-report ratings for valence and arousal provided after the participants viewed the IAPS images and film clips were consistent with predictions and norms. All participants rated the appropriate images and film clips as the intended valence and arousal level, with film clips being rated more strongly on all levels (Figure 4 & 5).

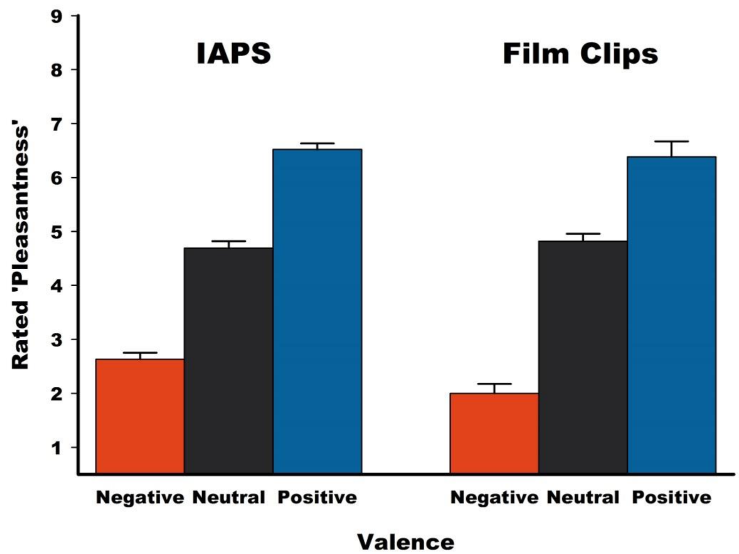

Figure 4. Valence ratings for IAPS images and film clips.

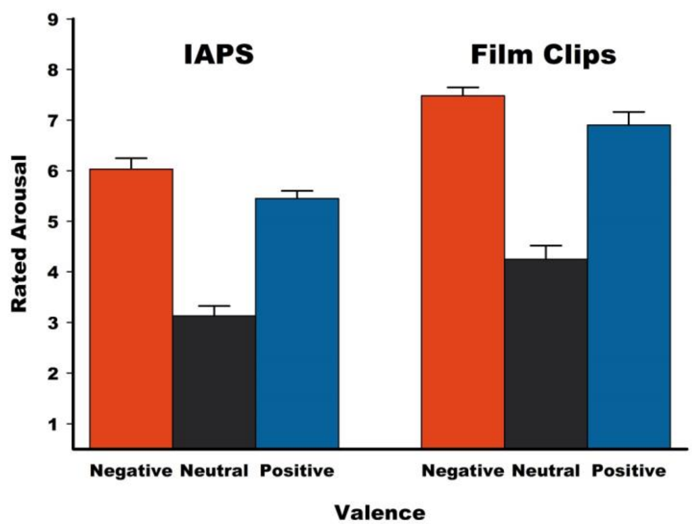

Figure 5. Arousal ratings for IAPS images and film clips.

CHAPTER FIVE

DISCUSSION

Consistent with predictions, the present study found trends supporting GLOMO^{sys} and the Broaden-and-Build hypotheses, such that positive emotional induction led to globalized visual processing while negative emotional induction led to localized visual processing. The present experiment was designed to address additional issues, specifically the potential differences between films clips and IAPS images for emotion induction. Therefore, the findings showed a significant difference on global and local processing between film clips and IAPS images. While participants responded as was predicted following IAPS images of amusing, fearful and neutral emotionality, the opposite was observed following film clips, such that, neutral film clips led to an activation in localized processing and fearful films led to an activation of globalized processing.

The negative IAPS images consisted of pointed guns and scenes of violence, which led to a more automatic fear response that localized perception. This finding is in line with both the Broaden-and-Build and GLOMO^{sys} theories, which assert that anxiety and fear localize processing in order to respond to threat. This was expected to be the case for the negative film clips and to localize processing more strongly than the IAPS images did. Although not all comparisons were found to be statistically significant, the patterns of responding suggested that IAPS images elicited the expected pattern of responding, while films showed the reverse (see Figure 1). Negative film clips globalized processing, which may be accounted for by their familiarity to participants. Most participants were able to identify the movies that the clips were taken from, hence they knew what to expect from the clip. This familiarity of the negative film clips may have distanced participants from the experience of the event, removing the threatening component. This may have allowed for globalized processing to take precedence, allowing the participant to watch the clip in its entirety rather than focusing and preparing for what might happen as the suspense built.

The opposite was observed for the neutral film clips, in that they localized processing. One possible explanation for this finding may be novelty effects. Unlike the negative films, the neutral were take from French films that none of the participants were familiar with. In addition, according to retrospective self-report, many of the participants reported feeling as if there was something negative looming, which may have created a sense of suspense and hypervigilance, which activated localized processing. This may provide a more appropriate depiction and model for how anxious individuals feel and experience the world; projecting negative outcomes and possibilities into an unknown future. The unknown is interpreted as negative and threatening, as was the case for participants watching the neutral film clips. However, another possibility was that the neutral clips may have been perceived by participants as incomplete gestalts, leaving them searching for the resolution and completion. This may have been the case because unlike the negative and amusing clips, the neutral were not complete scenes and lacked a definitive start, climax, or ending. These findings have implications for whether or not emotion is the full story when it comes to how the global and local processing systems are activated. It seems that there are many variables at play, including the experience of novelty and familiarity. Future studies should focus on showing whether extreme cases of novelty are experienced as threatening or whether valence and novelty are independent form one another.

Furthermore, the positive/amusing film clips also localized processing, as opposed to globalize processing as was predicted and the case with amusing IAPS images. This difference may be accounted for by the difficulty in matching IAPS images and the film clips on levels of amusement. For the film clips, participants were often observed to be laughing out loud, which was not the case with the positive IAPS images. The positive film clips, like the negative, were also familiar to the majority of participants, which would be expected to globalize as well. However, it is possible that humor and amusement activate global/local processing differently than a simple positive emotion like joy or peace. The amusing clips could have led participants to over-focus on the punch line of the jokes, hence become locally focused. Furthermore, performance following the positive film clips for global stimuli was the least accurate. Therefore, it seems that all positive emotions may not be created equally.

In terms of the IAPS images and use of film clips as emotion induction techniques, the results of the current study indicate that these methods may be qualitatively different in the emotional effects they elicit. Interestingly, according to the rating scales provided at the end of the IAPS image and film clip presentation, participants rated the IAPS and film clips similarly on valence and arousal measures, with film clips being rated as slightly stronger on both levels. However, the difference detected on the level of global or local processing activation indicates that the in the moment experience of certain emotions may occur below consciousness and not be consistent with self-report descriptions. This finding has implications for how future studies need to examine their findings and whether parallels can easily be made between different emotion induction techniques. Specifically, the neutral stimuli in the film clips did not seem to serve as a truly neutral emotion induction. In contrast, the neutral film clips brought about negative mood states rather than neutral. Furthermore, the film clips led to more inaccurate responding to the Navon task, as compared to the IAPS images. This again points to the potentially different processing that takes place when participants are exposed to these two types of stimuli. Specifically, it seemed that IAPS images and film clips, as well as multiple characteristics that each possessed, were processed differently, with the global and local systems being activated differentially. Further evidence for the different types of processing take place was that participants were significantly slower and less accurate when responding to the Navon task as compared to following the IAPS images, regardless of the valence of the stimuli.

Global and local processing may function as a continuum rather than as dichotomous systems. Therefore, certain external and internal stimuli may more readily activate a global or local level of processing to a greater or lesser extent. According to the findings in this study as well as previous work, it seems that both global and local processing systems are always present, but one may be more strongly or weakly activated at any given time. The system most strongly activated and taking precedence, impacts the emotional experience of the individual, and vice versa. There is likely a bidirectional flow, which has implications for potential treatment strategies aimed at training people to activate one system more readily than another. For instance, in people with anxiety disorders, research has shown there is a bias toward threatening information and more localized levels of processing. Therefore, training anxious individuals to activate the global processing system may serve to change their emotional experience and alleviate their experience of anxiety. However, future studies are needed to more systematically identify this bidirectional flow between levels of attending and emotional experience.

Although many trends supporting the hypotheses and previous theories were found, there were multiple limitations. First, many of the differences observed in this study between valence and view did not reach significance due to small sample size. Also, the task itself may have not been challenging and reached a ceiling, not allowing for stronger effects to be detected. However, the trends and patterns indicated by the results demonstrated that changes in emotional state bring about detectable patterns of attentional processing preference, which has both clinical implications and provides future directions for research in this area. Clinically, these findings demonstrate the potential to use specific emotion induction strategies to model symptoms of different psychological disorders. For instance, neutral film clips elicited an anxious and hypervigilant state, while negative IAPS images bought about a state of fearful surprise and call to action. These findings can have potential clinical implications for understanding how anxiety is maintained, and how certain symptoms can be treated using attention modification strategies.

Furthermore, future studies are needed to more systematically investigate how global and local processing systems are activated. For instance, are they two distinct systems or do they function as a continuum? The use physiological measure (i.e. heart rate and skin conductance) as well as neural data will likely help get more valid in the moment measures of what participants experience as opposed to relying on biased self-report data. Furthermore, future studies should focus on teasing out the effects of novelty and familiarity on global and local processing. These two systems have been shown to become activated by a variety of different psychological and environmental factors. Mapping out these triggers will guide researchers to more clearly manipulate these systems and possibly apply global and local processing activations for treatment purposes.

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