Faces and orientational metaphors: The effects of valenced faces and facial manipulations on neutral targets

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A Thesis
submitted to Victoria University of Wellington
in fulfilment of the requirements for the
degree of Master of Science
in Psychology

Victoria University of Wellington
2012

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Acknowledgements

I would like to thank Dr John McDowall, my supervisor, for his unwavering support, guidance, generosity, and patience. I would not have been able to complete this thesis without him. I would also like to thank the fifth year clinical cohort of 2011, with special mention to Michael Burrows and Gary Hewson for their assistance. Finally, I would like to thank my Mom, Dad, and older brother, Michael Moshenrose, for their love, support, and constant encouragement.

Abstract

Previous research has shown that there may be an association between affect (negative vs. positive) and vertical position (up vs. down) of stimuli. The following research aimed to investigate whether individuals show spatial biases, either up or down, when asked to respond to neutral targets after seeing valenced faces. The research also aimed to investigate what impact manipulating automatic facial mimicry responses would have on response times. The research was conducted over three experiments.

In Experiment 1, participants responded to neutral targets in either high or low vertical positions on a computer screen that were preceded by happy and sad schematic faces. There were two facial manipulation conditions. One group held a straw between their lips to inhibit smiling and another group held a straw between their teeth to facilitate smiling. A third group performed the response task without a straw (control condition). The procedure of Experiment 2 was identical to Experiment 1 except the happy and sad schematic faces had additional internal facial features (noses, eyebrows) that varied across trials. For both Experiment 1 and 2, targets preceded by a happy face were responded to significantly faster.

In Experiment 3, the procedure was identical to Experiments 1 and 2, except photographic images of happy, neutral, and sad expressions were used. Participants were significantly faster to respond to targets in the high vertical position. Participants were also faster to respond to targets in the control (no straw) condition than the other two straw conditions. In the inhibition smiling condition, participants were faster to respond to targets in the high vertical position than low vertical position after seeing a happy or neutral face. These findings indicate that there may be an association between valenced faces and vertical selective attention that is consistent with orientational metaphors (positive = up), but further research is needed to clarify this.

The use of metaphor is intrinsically tied to our language and our understanding of abstract concepts. In their book *Philosophy in the Flesh*, Lakoff and Johnson (1999) argue that metaphor is not limited to novel, poetic prose but is an essential, everyday part of language and understanding.

"You're in then you're out. You're up then you're down."

From the song "Hot N' Cold" by Katy Perry

The above lyrics reflect several orientational metaphors used to describe state of being. Orientational metaphors give an abstract concept, such as an emotion, a spatial orientation (Lakoff & Johnson, 2003). Orientational metaphors that include a description of verticality are commonly used to describe and understand emotional experiences (Meier & Robinson, 2004; 2006) For example, *happy is up* and *sad is down*. When someone is feeling depressed we say "They are feeling *down*." When someone has gone through a hard time and things are improving we say "Things are looking *up* for them." Metaphors that reference verticality are not limited to emotions. Objects, feelings, and experiences that are positive are often expressed as being "up" or "high" and things that are negative are "down" or "low" (Meier & Robinson, 2004) These types of orientational metaphors are also used to describe health (She's at the *peak* of health vs. His health is *declining*), consciousness (Wake *up.* vs. They *fell* asleep.), and rationality (It was a *high-level* intellectual discussion. vs. She *fell* back into despair, and let her emotions get the better of her). These are just a few additional examples but our everyday discourse is inundated with these types of metaphors (Lakoff & Johnson, 2003).

So why are good things up and bad things down so to speak? One theoretical framework that has been used to explain the phenomena of affect and vertical position is based on Piaget and Inhelder's (1969) theory of child development. In the initial stage of development, children's cognition is completely reliant on what they can feel, touch, taste, see, and hear (i.e. their sensorimotor experiences). While children are in this sensorimotor stage they are primarily on their back (a low vertical position). Caregivers provide love, care, and nourishment to children from above (a high vertical position). According to Tolaas (1991), after numerous pairings between positive emotion and high vertical position the association, *happiness and well-being are up*, will develop. As children continue their development, they gain the ability to think more abstractly and express themselves through language. An abstract concept (e.g. feeling happy) thus has a basis in sensorimotor experience and is consequently expressed through an orientational metaphor (e.g. feeling up).

Lakoff and Johnson (1999) extended this theoretical framework to argue that metaphor is not just a vehicle for disembodied abstract thought, but that abstract thought is wholly based on metaphors that are derived from the experience of having a body (embodiment). They reasoned that the very structure of an abstract concept, such as emotion or reason, is inherently shaped by the peculiarities of our bodies. We are not disembodied spheres floating around; instead we understand our bodies in spatial terms, such as up/down, front/back. Lakoff and Johnson (1999) argue that our conceptual frameworks are intrinsically linked to the commonalities of our physical bodies. What we do in physical space (e.g. standing up, sitting down) is usually very clear. However, our emotional experience, even though it is just as real as our experience of space, isn't as clearly defined. Utilising orientational metaphors, such as *happy is up,* allows us to conceptualise our emotional experiences in more sharply defined terms (Lakoff & Johnson, 2003). Because of our basic physical similarities we are able to go one step further and clearly define and understand the abstract experiences of others. The use of metaphor consequently leads to greater unity of perception and understanding.

There is empirical evidence that supports the association between vertical position (up vs. down) and affect (positive vs. negative). In an early study, Wapner, Werner, and Krus

(1957) asked participants to perform a spatial task after they had been induced into either a positive or negative emotional state. The mood induction involved participants sitting an examination. Half were told that they had received an A grade and the other half were told they received an F. An underlying assumption of Wapner et al. (1957) study was that the participants who received an A grade would feel happy and those who received an F would feel sad, however the participants' emotional state was not externally measured. After the results were given the participants were asked to view a 20cm x 20cm luminous square that was bisected through the middle with an opaque black line. The participant instructed the examiner to move the square up and down until the black line was at eye-level. The results of the study showed that the participants who received an A grade showed an upward bias when bisecting the square, whereas participants who received an F grade showed a downward bias. These results were consistent with the idea that affect influences spatial attention.

Fisher (1964) asked fifty-two participants to perform a visual-spatial task. Participants were shown rubber masks depicting human faces with neutral expressions. The masks were briefly illuminated for 1000ms. The participants were then asked to describe the face in detail. Participants who described the faces in negative, unhappy terms were deemed to have higher levels of negative affect themselves. Fisher incorporated autokinesis in his study to test whether participants showed an upward or downward bias. Autonkinesis is a perceptual phenomenon in which a stationery pinpoint of light appears to move in a dark, featureless environment (Adams, 1912). Participants were asked to draw the movement of the light. Participants with higher levels of negative affect drew the perceived movement in a significantly lower area than participants with low levels of negative affect. These results are again consistent with the view that higher levels of negative affect were associated with a downward bias in spatial attention.

Meier and Robinson (2006) investigated how individual differences in emotional experience of neurotic and depressive symptoms (negative affect) effects selective spatial attention. Participants' attention was focused in the centre of a screen and then response targets appeared in high and low positions. They found that participants prone to higher levels of negative affect were faster to respond to targets in a lower area of space compared to participants less prone to negative affective states, suggesting that individuals with high levels of negative affect may actually have a downward spatial bias. Meier and Robinson (2006) argued that this study supported the notion that affective states are represented physically in a way that is consistent with metaphor, i.e. "feeling down" also means "seeing down".

In the studies discussed so far there has been an emotional component to the research. Participants either already had high levels of negative affect (Fisher, 1964; Meier & Robinson, 2006) or they were induced into a negative or positive emotional state (Wapner, Werner, & Krus, 1957). Eder and Rothermund (2008) investigated whether motor responses were consistent with metaphoric representation. Participants were asked to determine if words were positive or negative by pushing or pulling a joystick. Previous research has shown that evaluation of positive stimuli is facilitated by arm-bending movement (pull = approach) and inhibited by arm-flexing movement (push = avoidance) (Chen & Bargh, 1999, cited in Eder & Rothermund, 2008). The push/pull movements were exactly the same across experimental conditions, but the context for the movements was different. Half the participants were told to *pull* the joystick *towards* them for positive words and *push* the joystick *away* for negative words (congruent with approach/avoidance theory) or *pull towards* for negative words and *push away* for positive words (incongruent with approach/avoidance theory). The other half were told to *push upwards* for positive words and *pull downwards* for negative words (incongruent with approach/avoidance theory) or *push* *upwards* for negative words and *pull downwards* for positive words (congruent with approach/avoidance theory). One of the expectations of the study was that responses to words would be faster in the conditions that were congruent with approach/avoidance theory. Eder and Rothermund’s (2008) results were consistent with this expectation in the *towards/away* conditions. However, the opposite was true in the *upwards/downwards* conditions. Participants were significantly faster to respond to stimuli in the *upwards/downwards* condition that was incongruent with approach/avoidance theory. To clarify, even though the participants were performing the motor movement associated with avoidance of negative stimuli (pushing), they were faster to respond to positive stimuli because pushing was contextualised as *upward* movement. Eder and Rothermund’s (2008) findings provide further evidence that orientational metaphors do not only exist in the abstract world of thought, but are also reflected by our physical movements.

Research conducted by Meier and Robinson (2004; 2006) has provided further evidence for the association between spatial position and affect. Meier and Robinson (2004) asked participants to evaluate the valence of 100 emotionally-toned words. Fifty words were positive (e.g. hero) and fifty were negative (e.g. liar). The words were presented randomly at the top of a computer monitor (high vertical position) or at the bottom of the monitor (low vertical position). Positive words were evaluated faster when they were presented at the top of the monitor as opposed to the bottom. Conversely, negative words were evaluated faster at the bottom of the monitor than the top. Meier and Robinson noted that because the spatial location of the words was manipulated a greater emphasis may have been inadvertently placed on spatial position, meaning orientational metaphors may have become more salient. To explore this, Meier and Robinson (2004) did a subsequent study to determine if the mere act of evaluating words, without spatial manipulation, influenced vertical attention. The same 100 positively and negatively charged words were presented one at a time in the centre of a monitor. After each word a letter target (p or q) was presented at the top of the monitor or the bottom. Participants had to identify the letter target with the correct key press. Participants were faster to identify targets at the top of the monitor that were preceded by a positive word, and they were faster to identify targets at the bottom of the monitor that were preceded by a negative word. This study provided evidence that mere exposure to valenced stimuli significantly influences spatial attention.

The studies conducted by Meier and Robinson (2004) used linguistic tasks. As I discussed earlier, Lakoff and Johnson (1999; 2003) argue that metaphor in abstract thought is pervasive and is the primary framework for understanding subjective experiences. Therefore, language based and non-language based cognitions should reflect metaphoric representations of space. Crawford, Margolies, Drake, and Murphy (2006) explored whether the association between orientational metaphors and affect extends to non-linguistic tasks. Sixty different emotionally evocative images in various spatial locations were sequentially presented on a computer monitor. Participants were asked to think about how each image made them feel. Once all the images had been presented, each image re-appeared in the centre of the monitor and participants were asked to drag the image to its original location (delayed recall). In a second study, participants were asked to produce the original location of the image immediately after it was presented (immediate recall). In both the immediate recall and delayed recall positions, participants were more likely to recall positively-toned images as appearing in a higher vertical position than negatively-toned images. This study provides further support for the association between affect and vertical position but also indicates that spatial biases may extend to memory for locations.

A criticism of the two studies conducted by Crawford et al. (2006) was that the findings may have arose because the negative images used included more content that is associated with the ground (i.e. snakes, dead animals) and the positive images included more content above ground (i.e. flying birds, winning athletes with raised fists). So the association measured may have been between location and content rather than valence and content (Crawford et al., 2006). To control for this, Crawford et al. (2006) conducted a third study where participants were presented with positive or negative descriptions of an individual followed by a yearbook photo in a random location on a monitor. They were then asked how to rate how they felt about the person in the photo. The photo re-appeared and they were asked to drag the photo to its original location. An upward bias was found for photos that were rated more positively, providing further evidence of the association between vertical position and affect.

As outlined thus far, several studies have investigated the metaphoric representation of affect in physical space. Overall, the research has supported the theory that orientational metaphors, where good things are up and bad things are down, do not only exist as a conceptual framework (Lakoff & Johnson, 1999) but are also evident in physical space.

Unlike previous studies that used words or pictures as the primary stimuli to investigate orientational metaphors in physical space, the present research incorporates valenced (happy and sad) faces. Research has shown that when emotionally expressive faces are observed the expression is subtlety mimicked (Dimberg & Thunberg, 1998) and the emotion is embodied (Niedenthal, 2007). A tenet of the current research is that this embodiment needs to occur for attentional biases to be evident. The evaluation of faces, embodied emotion, facial mimicry and their relationship to the current research are described in more detail in the following sections.

Evaluation of Faces

A wide breadth of research has shown that most individuals can evaluate facial expressions rapidly and accurately (Hansen & Hansen 1988; Samal & Iyegar, 1992; Todorov, Said, Engell & Oosterhof, 2008), and the meaning derived from facial expressions varies very little from culture to culture (Ekman, 1973; Ekman, 1992). Even infants are able to discriminate amongst emotional expressions to a certain extent (Schwartz, Izard, & Ansul, 1985). Willis and Todorov (2006) found that judgements made about unfamiliar faces as positive or negative remains relatively the same, regardless of whether the face is presented for a minimal duration (100ms) or a longer duration (500ms – 1000ms).

Studies have consistently shown that faces that convey a happy emotion are judged as more positive and faces that convey a negative emotion (i.e. sadness, fear, disgust) are judged as more negative (Lipp, Price, & Tellegen, 2009; Said, Sebe & Todorov, 2009). Research has also found that minimal exposure to positive and negative facial expressions can influence how affective stimuli are appraised. Niedenthal (1990) exposed participants to photographic images of faces conveying expressions of joy and disgust for 2ms. Due to the brevity of the exposure, the participants were not consciously aware they had seen a face but perceived the face implicitly. Once the face had been shown, participants were shown a novel cartoon for 2 seconds and asked to form an impression of the cartoon. Participants who were exposed to the negative faces (disgust) described the cartoon figure in more negative terms than participants who were exposed to the positive faces.

Said et al. (2009) found that faces do not even need to express a positive emotion, such as happiness, they only need to be perceived as looking positive to be evaluated more favourably. Participants were presented with an array of neutrally expressive faces and asked to determine certain trait characteristics, such as sociableness or meanness. The faces were then analysed by an emotion expression recognition programme. The faces with more trait characteristics associated with happiness, joy, and surprise were identified as conveying more positive emotion by the programme and the faces with trait characteristics associated with disgust, fear, and anger were identified as being more negative. The authors of this study argued that humans are finely tuned to determine what emotion a facial expression is conveying. They also argued the ability to recognise emotion through facial expressions can overgeneralise to faces that merely have a structural resemblance to a particular emotion (Said et al, 2009).

Investigations into the influences of facial expressions have used both human and schematic faces (Lipp et al. 2009a; 2009b; Lovegrove, 2009). Lipp et al. (2009b) used a facial search paradigm to investigate whether emotional faces, particularly faces expressing anger or sadness, are responded to faster than neutral faces. They found that faces that conveyed anger were processed fastest overall. This result was found for both photographic images of human faces and schematic faces. In a separate study, Lipp et al. (2009a) presented participants with schematic and human faces in upright and inverted positions. The participants were asked to rate how positive the faces were. Regardless of orientation, or face type (schematic vs. real), the faces that conveyed a happy expression were rated more positively than faces with sad or angry expressions. Lipp and colleagues' (2009a; 2009b) findings indicate that positive and negative facial expressions are evaluated with comparable strength for both schematic and real human faces.

Lipp and colleagues’ (2009a; 2009b) research complements other findings that have investigated schematic faces as useful stimuli in emotion perception research. Wright, Martis, Shin, Fischer, and Rauch (2002) presented participants with a 4 minute sequence of continuous images of schematic faces with varying facial expressions (e.g. angry, happy, and neutral) while scanning their brains using an fMRI. They found that the presentation of emotionally valenced schematic faces was associated with an increased fMRI signal in the amygdala, hippocampus, and prefrontal cortex. These areas of the brain have been identified as integral for processing emotional expressions in real faces (Breiter et al., 1996). These results support the use of schematic faces as effective stimuli in research. Furthermore, the use of schematic faces decreases the variance and confounding factors, such as gender or race that may arise when using real faces as stimuli (Martis et al., 2002).

Lovegrove (2009) investigated the influence of facial evaluation on vertical attention. Lovegrove asked participants to view schematic faces with an upturned mouth (happy expression) or downturned mouth (sad expression) and then respond to neutral targets (p or q) at the top or bottom of a computer screen. Participants responded faster overall to targets at the top of the computer screen; however, they were fastest when the target at the top of the screen had been preceded by a happy face. Lovegrove argued that this finding indicates that the presentation of a positively valenced face shifts attention upwards and is consistent with the metaphorical representation of affect, where “Good things are up” (Lakoff & Johnson, 1999).

Embodied Emotion

“Even the simulation of an emotion tends to arouse it in our minds.”

Charles Darwin (1872, p.366)

Darwin was one of the first scientists to evoke the concept that physiological experience actually has a direct impact on emotional experience. In the same era, Walt Whitman was evoking the concept of the mind or “soul” as being inextricably connected to the body through his poetry. Previously, emotions had been perceived as ephemeral and immaterial, but for both Whitman and Darwin the basis for emotion was in the body (Lehrer, 2008).

The philosopher William James was inspired by Whitman’s work and attempted to define the actual nature of emotion (James, 1884). In reference to encountering a bear in the woods he asked, “What kind of an emotion of fear would be left if the feeling of quickened heart beats nor of shallow breathing, neither of trembling lips nor of weakened limbs, neither of goose bumps nor of visceral stirring, were present?" James' answer to this was simple: there would be no fear without the body (Lehrer, 2008). Emotions are literally embodied.

James and Darwin provided theories about a bodily basis for emotions, but modern day neuroscience has provided evidence that emotional responses can be induced by manipulating the body itself. Several non-obtrusive methods have been designed to investigate how emotion is embodied. Stepper and Strack (1993) investigated embodied emotion by manipulating posture. Participants were asked to either adopt a conventional working posture or one of two "ergonomic" postures in which the participants had to sit with their heads held high and shoulders back and up or with their heads and shoulders slumped forward. The authors then presented the participants with the results from a staged achievement test and asked them to rate how proud they felt. All participants were given the same results and told that they performed far above average on the achievement test. Participants who sat in the upright position evaluated themselves as feeling more pride when they were told of their success than participants who had received their results in a slumped posture.

Researchers have also investigated how head movements influence preferential biases (Tom, Petterson, Lau, Burton, Cook, 1991; Förster & Strack, 1996; Förster, 2004). Under the guise of evaluating headphone comfort and listening quality, Förster and Strack (1996) asked participants to either nod, shake, or move their head in a circular movement. While listening to music on the headphones they were also played a series of positively and negatively valenced words, such as beautiful and terrible. Participants were given a recognition test to determine the number of words they could remember. The authors found that participants who nodded in the listening task remembered more positive words than negative words, but for participants who shook their heads in the listening task the opposite was true. They remembered more negative words than positive words.

Förster (2004) presented images of everyday consumable German products that were deemed negative or positive, such as beef lung and Snickers (candy bar). The images of the products moved across a computer screen from left to right, which induced head shaking, and from top to bottom, which induced head nodding. Positively rated products were rated even more favourably when participants nodded their heads. Negatively rated products were rated even less favourably when participants shook their heads. These results provide support for the notion that evaluations of behaviour towards affective stimuli become even more extreme when individuals adopt concurrent bodily movements (Förster, 2004).

All of these studies provide evidence for a reciprocal relationship between bodily movement, emotional experience, and evaluations of affective stimuli (Niedenthal, 2007). Research has also found that just manipulating facial movements alone may be enough to modulate emotional experience.

The Facial Feedback Hypothesis

"Sometimes your joy is the source of your smile, but sometimes your smile can be the source of your joy."

Thich Nhat Hanh

Tomkins (1962) was among the first to refine William James' (1890) theory that the body, particularly the face, influenced emotional experience. Imagine that two girls walk into a party. Both arrive to the party in the same, nonchalant mood. One is told to smile and the other is told to frown. Based on the facial feedback hypothesis the girl who is made to smile is more likely to have a positive experience, whereas the girl who was made to frown is more likely to have a negative experience. Tomkins argued that the face is the most sensitive, complex part of the body and rapidly sends sensory feedback to the brain, which is experienced as emotion (p.205-208). This theory became known as the facial feedback hypothesis. Over the past four decades, a wide body of research has provided empirical evidence that facial movement mediates emotional experience, evaluation of affective stimuli, and behaviour (Laird, 1974; Lanzetta, Cartwright-Smith, & Kleck, 1976; Buck, 1980; Strack, Martin, & Stepper, 1988; Soussigan, 2002).

Research into the facial feedback hypothesis has focussed on four questions: (1) Is facial action necessary for an emotion to be present? (2) Does the strength of the facial configuration correlate with the intensity of the emotional experience? (3) Does facial movement modulate the experience of emotionally evocative stimuli? and (4) Can facial movement evoke an emotional state without the presence of an emotional event? (Toureangeau & Ellsworth, 1979; Adelmann & Zajonc, 1989; McIntosh, 1996; Soussigan, 2002). Over the past four decades, a wide body of research has provided empirical evidence that facial movement mediates emotional experience, evaluation of affective stimuli, and may induce an emotional state without an emotional stimulus (see Adelmann & Zajonc, 1989, McIntosh, 1996).

The first experiments that were designed to test the facial feedback hypothesis used intrusive measures such as electrodes (Laird, 1974) or electric shock (Lanzetta, Cartwright-Smith, & Kleck, 1976). Lanzetta and colleagues (1976) asked participants to hide or exaggerate the discomfort they felt while receiving electric shocks of varying intensity. They were then asked to rate their pain levels immediately after each shock. In conditions, where the pain response was supressed pain level ratings were lower, but in conditions where the pain response was exaggerated the level of reported painfulness also increased.

Strack, Martin, and Stepper (1988) investigated the facial feedback hypothesis by devising a non-obtrusive method to facilitate or inhibit smiling. Three groups of participants were asked to view cartoons and rate how funny they found each cartoon. One group was asked to hold a pen between their teeth to activate the facial muscles associated with smiling. Another group was asked to hold the pen between their lips to inhibit the facial muscles associated with smiling. A third group acted as the control group and was asked to hold a pen in their non-dominant hand. Participants that were made to inhibit smiling gave the cartoons lower funniness ratings than the participants who held a straw between their teeth to facilitate smiling and those in the control condition. The authors concluded that manipulating facial expressions influences the subjective emotional experience of affective stimuli. The emotional experience is intensified if the facial-muscular activity is congruent with the valence of the stimuli (i.e. smile muscles activated + funny cartoon = greater humour response) and inhibited if the facial-muscular activity is incongruent with the valence of the stimuli (i.e. smile muscles inhibited + funny cartoon = less humour response).

Soussigan (2002) also investigated the facial feedback hypothesis through non-obtrusive means. Soussigan asked participants to either hold a pencil in their mouth and drop their jaw, hold a pencil between their lips, hold a pencil between their teeth with the mouth corners pulling up (non-Duchenne smile), or hold a pencil between their teeth with mouth corners pulling up and cheeks raising (Duchenne smile). A Duchenne smile, otherwise known as a “true smile”, involves contraction of both the zygomaticus major muscle (corners of mouth raise) and the orbicularis oculi muscle (raises cheeks), whereas a non-Duchenne smile only involves the contraction of the zygomaticus major muscle, meaning only the corners of the mouth raise (Soussigan, 2002). Studies have indicated that a full Duchenne smile is more indicative of a genuine, spontaneous emotional response than other smiles (Ekman, Friesen, & O’Sullivan, 1988).

While performing one of the four facial motor tasks in Soussigan’s (2002) experiment participants were asked to view videotaped scenes that were emotionally evocative and either mildly positive or negative or strongly pleasant or negative. For example, a mildly positive video clip was a chimpanzee swinging amongst the branches of a tree and a strongly negative clip was a doctor examining the area where toes had been amputated from a foot. The experimenters asked the participants to rate their reaction to each scene on a scale from -9 (very negative) to +9 (very positive). This study found that participants that were made to display the Duchenne smile reported greater positive emotional experience when pleasant and humorous scenes were presented. However, participants who displayed the non-Duchenne smile showed no difference from the controls in how pleasant or humorous they found the stimuli. These findings indicate that the sensory input from facial-muscular activity influences emotional experience and evaluation of emotionally evocative stimuli. Soussigan argued that based on the results facial feedback has greater influence on subjective emotional experience when the facial-muscular activity more closely resembles the actual emotional expression, such as a Duchenne smile.

Moshenrose's (2010) research also provided support for the facial feedback hypothesis. Participants were asked to respond to neutral targets after viewing happy and sad schematic faces. One group was asked to hold a straw between their lips to inhibit smiling and the other group performed the response task without a straw. Participants responded faster to targets after seeing a happy face and slower to targets preceded by a sad face. However, in the smiling inhibition group there was no difference in response times after viewing happy or sad faces. Faster reaction times towards happy faces have been documented for both real and schematic faces (Kirita & Endo, 1995; Leppänen, Tenhunen, Hietanen; 2003). Moshenrose (2010) argued that by inhibiting smiling participants' evaluations of positive stimuli were also inhibited providing support for the facial feedback hypothesis.

In the past two decades, there has been an upsurge in the prevalence and use of non-surgical cosmetic procedures such as Botox and Restylane injections. There have been numerous reports of individuals as appearing "frozen" or as if they are wearing a mask after they undergo these procedures. The active element of Botox is Botulinum neurotoxin

(BoNT-A). After BoNT-A is injected into facial muscles, nerve signals still continue to travel down the axon to the muscle but no neurotransmitters are released meaning that the muscle lies inert and no muscular feedback is sent back to the brain as long as the BoNT-A is active (Dolly & Aoki, 2006; Davis et. al, 2010). Some researchers argue that this short-term disruption in facial feedback may modulate emotional experience (Finzi & Wasserman, 2006; Davis, Senghas, Brandt, & Oschner, 2010).

In Finzi and Wasserman's (2006) study 10 patients who had moderate to severe depression were given Botox injections in their frown lines (corrugator supercilii muscles). Two months after treatment, nine out of 10 patients were no longer clinically depressed, indicating that Botox may have a mediating effect on mood and negative internal states. A difficulty with this study was that there was no comparative control group and other external factors were not taken into account, such as changes in employment or relationship status. Davis et al., (2010) investigated the facial feedback hypothesis by exploring the effects Botox had on subjective emotional experience. Participants were split into two groups and given either Botox or Restylane injections. Both types of injections targeted the participants' frown lines (corrugator supercilii) and laugh lines (orbicularis oculi). Restylane, unlike Botox, is a water-based filler and has no known effect on muscular activity (Brandt & Cazzaniga, 2007, as cited in Davis et. al, 2006). Participants were shown sets of positive, mildly positive, and negative videos eight days before the injections and two to three weeks afterwards. They were then asked how they felt during the presentation of the video on a scale from -4 very negative, 0 neutral, +4 very positive. The study found that participants injected with Botox exhibited a significant decrease in the intensity of their reports about their emotional experiences compared to the Restylane group. The authors argued that this result supported the facial feedback hypothesis. The individuals' emotional responses to affective stimuli were lessened because the Botox decreased the facial muscular activity, which consequently decreased the muscular feedback to the brain.

All of these studies provide empirical evidence that facial muscular activity influences emotional experience and evaluations of affective stimuli. The present study investigated whether manipulating facial muscular activity influences attentional allocation when emotionally expressive faces are presented.

Facial Mimicry

As outlined previously, several studies have shown that emotionally charged information is processed faster if an individual is embodying a similar emotion and slower if the emotion is incongruent with the stimuli (Strack, Martin, & Stepper, 1988; Soussigan, 2002, Niedenthal, 2007). There is also a considerable body of evidence showing that just observing facial expressions that are indicative of emotions, such as anger or happiness, can result in similar, spontaneous facial configurations in the observer (Dimberg & Karlsson, 1997; Dimberg & Thunberg, 1998). Some researchers have suggested that this is an adaptive biological response (Tomkins, 1962; Dimberg, 1982) and occurs as early as infancy (Termine & Izard, 1988).

Dimberg and Karlsson (1997) repeatedly showed participants a series of images that included angry and happy facial expressions, snakes and flowers, and neutral nature scenes while measuring subtle facial movements using a facial electromyography recorder (EMG). They found observing happy faces increased zygomaticus major muscle activity, the primary muscle implicated in smiling (Dimberg, 1982; Ekman et. al, 1998). Whereas viewing angry faces increased corrugator supercilli muscle activity, implicated in frowning. In a later study, Dimberg and Thunberg (1998) found that these subtle facial movements happen rapidly and were detectable after only 300ms to 400ms of exposure to affective facial stimuli (Dimberg & Thunberg, 1998).

Research also suggests that these responses may operate without explicit processing (Dimberg, Thunberg, & Elmehed, 2000). Using a backward masking technique, Dimberg and colleagues (2000) presented participants with images of angry, happy, and neutral faces for 30ms. They found that even though exposure to the happy and angry faces was implicit, participants still responded with facial muscular activity that was consistent with the emotion being expressed in the masked image (i.e. increased zygomaticus major muscle activity for happy faces, and increased corrugator supercilli activity for angry faces).

Wild and colleagues (2001) investigated whether the presentation of emotionally expressive faces not only influenced facial-muscular responses but also the subjective emotional response of the observer. After viewing happy and sad faces, participants rated the strength of their experienced emotions (i.e. happiness, sadness, anger, disgust, surprise, fear, and pleasure). Feelings of reported happiness and sadness were repeatedly evoked after the congruent facial expression was presented (Wild, Erb, & Bartels, 2001). One explanation that has been provided for these finding is that individuals automatically respond to emotionally expressive faces by mimicking the same muscular movement that is involved in the emotion. By doing this the individual embodies the emotion and experiences a similar subjective emotional state as the one being observed, which in turn facilitates emotional understanding (Niedenthal, Brauer, & Halberstadt, 2001; Niedenthal, 2007).

If the above explanation is correct, then blocking the automatic facial mimicry response should impair recognition of emotionally evocative facial expressions (Niedenthal, Brauer, & Halberstadt, 2001; Oberman, Winkielman, & Ramachandran, 2007). Niedenthal and colleagues (2001) asked participants to detect when a morphing face changed either from a happy to sad expression or sad to happy expression. During the experiment, some participants were asked to hold a pen between their lips (Strack, Martin, & Stepper, 1988) to inhibit facial mimicry, whereas the other participants were able to move their faces freely.

Participants in the inhibition condition identified the change in expression slower suggesting that facial mimicry is involved in facial expression recognition. Oberman and colleagues (2007) research replicated Niedenthal et al.'s (2001) study. They also found that recognition for happy faces was the most impaired when facial mimicry was inhibited and argued that facial mimicry may play a greater role in identification of certain emotional expressions, such as happiness.

Findings such as these allow us to investigate specific hypotheses that form the basis for the present study: When viewing faces is attentional allocation consistent with metaphoric representations of affect? Is it sufficient to perceive (for example) a facial expression for spatial attention to be influenced or is it necessary to experience the emotion compatible with the facial expression? How does interfering with facial mimicry, by facilitating or inhibiting facial muscular activity, influence attentional allocation in the presence of affective stimuli?

Current Research

The focus of the current investigation is to combine the previous literature, and investigate whether individuals show spatial biases (up or down) when asked to perform a facial motor task, view faces, and respond to neutral targets. There will be three separate experiments in total. In the first, participants will be asked to respond to neutral targets after viewing happy and sad schematic faces while holding a straw between their lips (inhibit smiling), between their teeth (facilitate smiling), or while holding no straw. This technique is derived from the research conducted by Strack, Martin, and Stepper (1988) and has also been utilised effectively in other investigations (Moshenrose, 2010; Niedenthal et al., 2001) In the second experiment, participants will perform the same facial motor tasks as Experiment 1, but respond to neutral targets after viewing schematic faces with varying levels of details (i.e. eyebrows, ears, noses, etc.). The procedure of the third experiment will be identical to the previous two, but participants will respond to targets after viewing pictures of real faces. The procedures for all three experiments have been granted ethical approval by Victoria University of Wellington Ethics Committee.

Experiment 1

The purpose of Experiment 1 is to combine the previous literature and extend Lovegrove's (2009) and Moshenrose's (2010) research. This experiment will investigate whether individuals show spatial attentional biases (up or down) that are consistent with orientationtal metaphors (where positive is up and negative is down). Participants will be asked to respond to neutral targets in high or low vertical positions after viewing schematic faces that are happy (have an upturned mouth) or sad (have a downturned mouth). Responding to targets in this way will provide information about the pattern of vertical selective attention and identify any spatial biases (Meier & Robinson, 2004). Some participants will also be asked to hold a straw between their lips or teeth to inhibit or facilitate smiling (Stepper, Martin, & Strack, 1988). The purpose of utilising this technique is to examine whether subtle facial manipulations influence how affective stimuli are responded to, specifically whether these types of manipulations have an effect on vertical selective attention.

Based on the literature from spatial metaphor, evaluation of facial expressions, and the facial feedback hypothesis the hypotheses for this experiment are as follows: (1) If the evaluation of facial expressions is consistent with orientational metaphor, then participants attention will be shifted upwards after viewing happy faces and they will respond faster to targets in a high vertical position and slower to targets in a low vertical position, and their attention will be shifted downwards after viewing sad faces and will consequently respond faster to targets in a low vertical position than a high vertical position. (2) When participants inhibit smiling their attention will be shifted downwards and they will respond the fastest to targets in a low vertical position, but the opposite will be evident when participants facilitate smiling and they will respond fastest to targets in a high vertical position. (3) In the facial manipulation conditions, it is also expected that participants will respond faster to targets that are congruent to the facial expression they are embodying and slower to incongruent stimuli (i.e. when facilitating smiling participants will respond faster to targets preceded by a happy face but slower to targets preceded by a sad face).

Method: Experiment 1

Participants

One hundred and thirty six undergraduate students from Victoria University of Wellington participated in this study. There were 50 males and 86 females and the average participant age was 19.4 years. Participation was voluntary and all participants were given partial credit towards a research participation requirement for an undergraduate psychology course.

Apparatus

The study was run on Dell desktop computers in a lab containing 20 individual computers. Up to 10 participants participated in each session. The computer program used in this study was written in E-Prime (Schneider, Eschman, & Zuccolotto, 2002a; 2002b) and included instructions for the study, generated stimuli as required, and recorded correct and incorrect responses made by participants.

Two black and white schematic faces, with grey eyes were used. One had a happy expression (upturned mouth) and the other had a sad expression (downturned mouth) (See Appendix B). The original images were created in Microsoft Paint. The images were modified to ensure that the eyes did not create any directional biases. The target letters ‘P’ and ‘Q’ were presented in black Helectiva size 48 font. Target letters were centred horizontally for all conditions. A standard QWERTY keyboard was used for participant response. Plastic straws purchased from the grocery store were used to inhibit and facilitate smiling.

Design

A factorial 2 x 2 x 3 mixed design was utilised. Two factors were manipulated within subjects. The first within subjects factor was vertical position of the target letter (high vs. low) and the second within subjects factor was valence of the schematic face (happy vs. sad). The third factor was manipulated between subjects. One group was asked to hold a straw between their lips throughout the experiment to inhibit smiling; another group was asked to hold the straw between their teeth to facilitate smiling, and the other group acted as a control group and went through the experiment without a straw. The dependent variable was response time to the target letters in milliseconds.

Procedure

Participants were seated at individual computers and given information sheets about the experiment (see Appendix A). Once participants had given their consent to participate, they were presented with instructions on the computer. Participants were advised that they would see a face in the centre of the screen that would disappear followed by a target letter, either a ‘P’ or a ‘Q’ at the top or bottom of the screen. A blank screen appeared for 500ms followed by a fixation cue (+) which was displayed in the centre of the screen for 500ms. Following this, the schematic face was displayed for 1000ms for each trial. The target letter appeared either in the high vertical position (100 pixels from the top of the screen or in the low vertical position (600 pixels from the top of the screen). Participants were instructed to respond as quickly as possible to the target and press the ‘P’ key with their right index finger if they saw a P, or press ‘Q’ with their left index finger if they saw a Q. The target letter remained visible until the participant had made a response. Once the participant responded, a new trial began and the fixation cue was displayed followed by a schematic face in the centre of the screen.

Prior to beginning the experiment, participants were told that they would have to perform a facial motor task while responding to targets. The researcher handed out straws and demonstrated how to properly hold the straw in their teeth, to facilitate smiling, or in their lips to inhibit smiling. Each participant was checked to ensure they were holding the straw correctly. Participants were advised that they would need to hold the straw in their teeth or lips for the duration of the experiment. See Appendix A for a depiction of the techniques used to inhibit or facilitate smiling.

All participants completed 100 trials. Each face type was presented 50 times. The target letter appeared at the top of the screen 50 times and the bottom of the screen 50 times. Trials were presented randomly. All scores were recorded and transformed into individual averages for each condition. Singular response times that were less than 300ms or greater than 1200ms were excluded. Once participants had completed the experiment they were thanked for their participation and debriefed.

Results: Experiment 1

A 2 (Position: up vs. down) x 2 (Valence: sad vs. happy) x 3 (Straw Condition: facilitation vs. inhibition vs. no straw) mixed ANOVA was used to analyse the data collected for experiment one. The alpha level was set to 0.05. There was significant main effect for Valence, F (1, 135) = 52.917, $p < 0.05$. Participants responded significantly faster to targets after a happy face was presented (M = 524.39ms) but slower to targets after a sad face was presented (M = 549.87ms). There were no significant main effects for Position, F (1, 135) = .179, $p > 0.05$ or condition F (2, 133) = 2.762, $p > 0.05$. There were no significant interactions amongst the variables. It should be noted, that there was a trend for an interaction between Position x Condition, F (2, 133) = 2.834, $p = 0.062$. Response times were faster in the no straw condition for targets in the up position (*M* = 527.6ms) than the down position (*M* = 536.12ms), but in the inhibition straw condition response times were faster for targets in the down position (*M* = 520.67ms) than the up position (*M* = 529.65ms).

Discussion: Experiment 1

This experiment aimed to investigate whether individuals show spatial biases after viewing affective facial stimuli (happy and sad schematic faces). The experiment also aimed to investigate what effect manipulating facial posture would have on vertical selective attention. It was expected that spatial biases would be reflective of orientational metaphors, where positive things are up and negative things are down, and that response to targets after viewing affective stimuli would be influenced by facilitating or inhibiting automatic facial mimicry processes. The results of this experiment were not consistent with the predicted outcomes. However, there was a significant main effect for Valence. Overall, participants responded faster to targets after seeing a happy face. A "happy face advantage" has been well documented for facial expression recognition (Kirita & Endo, 1995; Leppänen et. al, 2003; Leppänen & Hietanen, 2003). This result is also partially supported by Lovegrove's (2009) research, in which the author found that participants responded significantly faster to targets in a high vertical position after seeing a happy face.

A possible explanation as to why the present results were not consistent with expected outcomes is that the schematic faces used in this study were too simple. Lovegrove (2009) also used schematic faces, but these faces had additional features such as noses, ears, and hair. Furthermore, the finding that inhibition and facilitation of smiling had no impact on response times may also be due to the simplicity of the schematic faces. These issues are investigated in Experiment 2.

Experiment 2

Previous research that has effectively incorporated schematic faces as affective stimuli have used faces with greater levels of facial detail such as eyebrows, noses, and ears (Lipp et al., 2009a; Lovegrove, 2009; Wright et. al, 2002) than what was used in Experiment 1. Tipples and colleagues (2002) found that certain schematic faces were detected faster when the schematic face had additional internal facial features such as eyes, a nose, and mouths. Researchers have argued that the inclusion of eyebrows is salient to how facial expressions are holistically processed in both real and schematic faces (Sadr, Jarudi, Sinha, 2002; Tipples et al., 2002). Consequently, the level and type of internal facial features that are included in schematic faces may have an impact on how they are processed.

Experiment 2 aims to investigate what effect varying the level of internal facial features has on spatial attention and whether particular features, such as the inclusion of eyebrows or noses, impacts how attention is allocated. If additional facial features do have an impact then it is expected that spatial attention will shift in a manner that is consistent with metaphor, i.e. reaction time to targets in a high vertical position will be faster after the presentation of a more detailed happy faces and slower to targets in a low vertical position, and faster for targets in the low vertical position that are preceded by a more detailed sad face. A further question that this experiment will investigate is whether more detailed schematic faces have enough salience to elicit facial mimicry and an embodied emotional response (Niedenthal, 2007). If the automatic facial mimicry response is elicited what impact will disrupting this response have on reaction times? As in experiment 1 it is expected that facilitating smiling will shift attention upwards and participants will be faster to respond to targets in the high vertical position and slower to targets in the low vertical position, but inhibiting smiling will have the opposite effect. It is also expected that participants will be faster to respond to targets preceded by stimuli that are congruent with the facial manipulations. Participants will be faster to respond to targets after seeing a happy face and slower after seeing a happy face if they are in the facilitation smiling condition, and faster to respond to targets after seeing a sad face if they are in the inhibition smiling condition. Furthermore, based on the results from experiment 1 and research indicating that people react faster to happy faces (Kirita & Endo, 1995) it is expected that overall participants will respond faster to targets after viewing a happy face (i.e. schematic face with upturned mouth).

Method: Experiment 2

Participants

Sixty-five (37 females and 28 males) undergraduate students from Victoria University of Wellington volunteered to participate in this experiment. The average participant age was 19.5 years. Participants were awarded research credit for an undergraduate psychology course for their participation.

Apparatus

The apparatus used for Experiment 2 was identical to the apparatus used in Experiment 1. The only difference was the face stimuli used. Eight schematic faces were used (see Appendix C) with varying features. There were two sets of faces. One set of faces had happy expressions (upturned mouths) and the other had sad expressions (downturned mouth). The features of the faces were as follows: eyes and mouth; eyes, mouth, and nose; eyes, mouth, and eyebrows; eyes, mouth, nose, and eyebrows. The eyebrows were designed to be horizontal to eliminate spatial biases. All the faces were black and white with grey eyes and were constructed in Microsoft Paint.

Design

A factorial 2 x 2 x 4 x 3 mixed design was utilised. Three factors were manipulated within subjects. The first within subjects factor was vertical position of the target letter (high vs. low). The second within subjects factor was valence of the schematic face (happy vs. sad). The third within subjects factor was the features presented on each face (eyes/mouth vs. eyes/mouth/nose vs. eyes/mouth/eyebrows vs. eyes/mouth/nose/eyebrows). The fourth factor was manipulated between subjects. This factor was identical to the straw condition in Experiment 1. One group was asked to hold a straw between their lips throughout the experiment to inhibit smiling; another group was asked to hold the straw between their teeth to facilitate smiling and the other group acted as a control group and went through the experiment without a straw. The dependent variable was response time to the target letters in milliseconds.

Procedure

The procedure of Experiment 2 was identical to Experiment 1. Nineteen participants were asked to hold a straw between their lips to inhibit smiling, 22 held a straw between their teeth to facilitate smiling, and 22 acted as controls and were asked to complete the experiment without a straw. The experiment was split into two blocks of 80 trials with a 60 second break in between the blocks. All participants completed 160 trials. Each face type was presented 40 times (20 times with upward targets and 20 times with downward targets). The target letter was presented at the top of the screen 80 times and at the bottom of the screen 80 times. Trials were presented randomly. All scores were recorded and transformed into individual averages for each condition. Singular response times that were less than 300ms or greater than 1200ms were excluded. Once participants had completed the experiment they were thanked for their participation and debriefed.

Results: Experiment 2

A 2 (Position: up vs. down) x 2 (Valence: sad vs. happy) x 4 (Features: eyes/mouth vs. eyes/mouth/nose/ vs. eyes/mouth/eyebrows vs. eyes/mouth/nose/eyebrows) x 3 (Straw Condition: facilitation vs. inhibition vs. no straw) mixed ANOVA was conducted to analyse the data collected from experiment two. The alpha level was set to 0.05. There was a significant main effect for Valence F (1, 65) = 23.951, $p < 0.05$. Similar to Experiment 1, participants responded faster to targets after a happy face was presented (M = 546.7ms) but slower to targets after a sad face was presented (M = 568.47ms). There were no significant main effects for Position, F (1, 65) = .585, $p > 0.05$, or Condition, F (2, 64) = .213, $p > 0.05$. There were no significant interactions amongst the variables.

Discussion: Experiment 2

As in Experiment 1, it was expected that participants would respond faster to targets preceded by a happy face. This hypothesis was supported by the results of experiment 2. Reaction times to neutral targets were faster after the presentation of a happy face. This response bias occurred regardless of whether the face that was displayed just had eyes and an upturned mouth or additional features, such as a nose or eyebrows. It was hypothesised that participants would show spatial biases consistent with orientational metaphor after viewing detailed schematic faces and that disrupting automatic facial mimicry responses would impact response times to targets and attentional allocation. The results of this experiment did not provide support for these predictions.

A possible explanation for these results is that schematic faces are not processed in a way that invokes automatic facial mimicry responses. Proponents of facial mimicry argue that when an observer is presented with a facial expression the expression is imitated on a subtle, physical level (Dimberg & Thunberg, 1997; Dimberg & Karlsson, 1998). The observer actually embodies the observed expression (Niedenthal, 2007). Facial mimicry responses have been reported in studies that use real life face to face interactions (McIntosh, 2006) , photographic images of facial expressions (Dimberg & Thunberg, 1997; Dimberg & Karlsson, 1998), morphing photographic images (Niedenthal et al., 2001), and even three dimensional representations of faces (Likowski, Mühlberger, Seibt, Pauli, & Weyers, 2007).

Though previous research has provided support for the use of schematic faces as affective stimuli (Lipp et al., 2009a; 2009b; Lovegrove, 2009; Tipples et al., 2002), there are no specific facial mimicry studies that have incorporated schematic faces.

Several accounts have arisen to explain the facial mimicry phenomenon. One such account is the activation of a mirror neuron system. Researchers into this field argue that mirror neurons are specialised neurons that fire during observation in a way that is identical to the observer performing the action (Gallese, Keysers, & Rizzolatti, 2004). This system forms the fundamental basis for understanding the emotional experience of others. When an individual sees an emotional expression of another person the mirror neuron system is activated, the musculature related to the emotion is mimicked, and the emotion is consequently embodied on a subtle level in the observer (Gallese, Keysers, & Rizzolatti, 2004). The mirror neuron account for embodied emotion and facial mimicry is relatively new, and consequently there has not been any specific research investigating whether the mirror neuron system is activated after the presentation of schematic faces. This may mean that schematic faces do not activate the same neuronal systems as real faces that lead to facial mimicry. Consequently, if the expressions presented from the schematic faces were not embodied then disrupting the facial mimicry response would have no effect, as was indicated by the results from Experiments 1 and 2. Experiment 3 was conducted to address these issues.

Experiment 3

It is possible that the schematic faces used in Experiments 1 and 2 did not activate facial mimicry responses, meaning the emotions presented in the response task were not physically embodied. The focus of Experiment 3 is to investigate whether photographic images of real faces expressing emotion create attentional biases that are consistent with metaphor, and to investigate what effect disrupting automatic facial mimicry responses has on reaction to neutral targets and attentional allocation. The stimuli that will be used in this experiment will be real images of two individuals portraying happy, sad, and neutral expressions. If processing facial expressions is consistent with metaphoric representations of affect then it is expected that response times to targets in the high vertical position will be faster preceded by a happy expression than a sad expression, but response times will be faster to targets in the low vertical position preceded by a sad expression. Also, targets preceded by a neutral expression will not bias attention up or down. As previously hypothesised, it is expected that facilitating smiling will shift attention upwards and participants will be faster to respond to targets in the high vertical position and slower to targets in the low vertical position, but inhibiting smiling will have the opposite effect. It is also expected that participants will be faster to respond to targets preceded by stimuli that are congruent with the facial manipulations. Response times to targets will be faster after seeing a happy expression and slower after seeing a sad expression in the facilitation smiling condition and faster to targets after seeing a sad expression in the inhibition smiling condition. Furthermore, based on the results from Experiments 1 and 2, it is expected that there will be a "happy face advantage" and participants will respond faster to targets after viewing a happy expression.

Method: Experiment 3

Participants

One hundred and seven (42 males and 65 females) undergraduate psychology students from Victoria University Wellington volunteered to participate in this study. Participants were given credit for an undergraduate psychology for their participation.

Apparatus

The apparatus used for Experiment 3 was identical to the apparatus used in Experiments 1 and 2 except for the facial stimuli that was used. Six black and white photographic images of real human faces were used (see Appendix D). The photographic images were obtained from the MMI Facial Expression Database collected by Valstar and Pantic (2010). Three images were of a male exhibiting happy, neutral, and sad facial expressions. The other three images were of a female exhibiting happy, neutral, and sad facial expressions. The expressions were rated as happy, neutral, and sad externally by the MMI Facial Expression Database (Valstar & Pantic, 2010). The images were rendered black and white in Microsoft Paint. Each image was sized to appear as 250 x 250 megapixels on the computer screen.

Design

A factorial 2 x 3 x 3 mixed design was incorporated. The first within subjects factor was the vertical position of the target letter (high vs. low). The second within subjects factor was the valence of the face (happy vs. neutral vs. sad). The third factor was manipulated between subjects. This factor was identical to the straw condition outlined in Experiment 1 and used in both previous experiments. One group was asked to hold a straw between their lips throughout the experiment to inhibit smiling; another group was asked to hold the straw between their teeth to facilitate smiling, and the other group acted as a control group and went through the experiment without a straw. The dependent variable was response time to the target letters in milliseconds.

Procedure

The procedure for Experiment 3 was identical to the previous two experiments. Thirty-five participants were asked to hold a straw between their lips to inhibit smiling, 31 held a straw between their teeth to facilitate smiling, and 41 participants were asked to complete the experiment without a straw. All participants completed 180 trials. Each photographic image was presented 30 times (15 times with upward targets and 15 times with downward targets). The target letter was presented at the top of the screen 90 times and at the bottom of the screen 90 times. Trials were presented randomly. All scores were recorded and transformed into individual averages for each condition. Singular response times that were less than 300ms or greater than 1200ms were excluded from the data analysis. Once participants had completed the experiment they were thanked for their participation and debriefed.

Results: Experiment 3

The mean response times and standard deviations for each condition are shown in Table 1.

Means and standard error of response times in milliseconds. .

	Control (No Straw)		Inhibition		Facilitation	
	Mean	SD	Mean	SD	Mean	SD
Happy Up Target	499.33	9.68	519.30	10.45	546.39	11.13
Happy Down Target	507.10	10.95	545.13	11.85	554.53	12.59
Neutral Up Target	496.44	10.02	530.09	10.85	543.62	11.52
Neutral Down Target	517.02	10.54	542.49	11.41	551.79	12.13
Sad Up Target	495.83	9.66	527.97	10.46	543.39	11.11
Sad Down Target	508.29	10.63	534.80	11.50	555.46	12.22

A 2 (Position: up vs. down) x 2 (Valence: sad vs. happy) x 3 (Straw Condition: facilitation vs. inhibition vs. no straw) mixed ANOVA was conducted to analyse the data collected from experiment three. The alpha level was set to 0.05. There was a significant main effect for Position, F (1, 106) = 21.035, $p < 0.05$. Participants responded faster to targets in the up position (M = 522.48ms) than the down position (M = 535.07ms). There was also a significant main effect for Condition, F (2, 104) = 4.951, $p < 0.05$. Participants were significantly faster to react to targets in the control (no straw) condition as compared to both the inhibition and facilitation (straw) conditions.

There was a significant three-way interaction between Position x Valence x Condition, F (4, 208) = 4.076, $p < 0.05$. A post-hoc repeated measures ANOVA was performed on the data from each condition. These tests revealed that the three-way interaction was driven by the inhibition straw condition, Position x Valence F (2, 68) = 5.000, $p < 0.05$ (see Figure 1). A series of post-hoc paired-samples t-tests were used to determine where the significant interactions were in the inhibition condition.

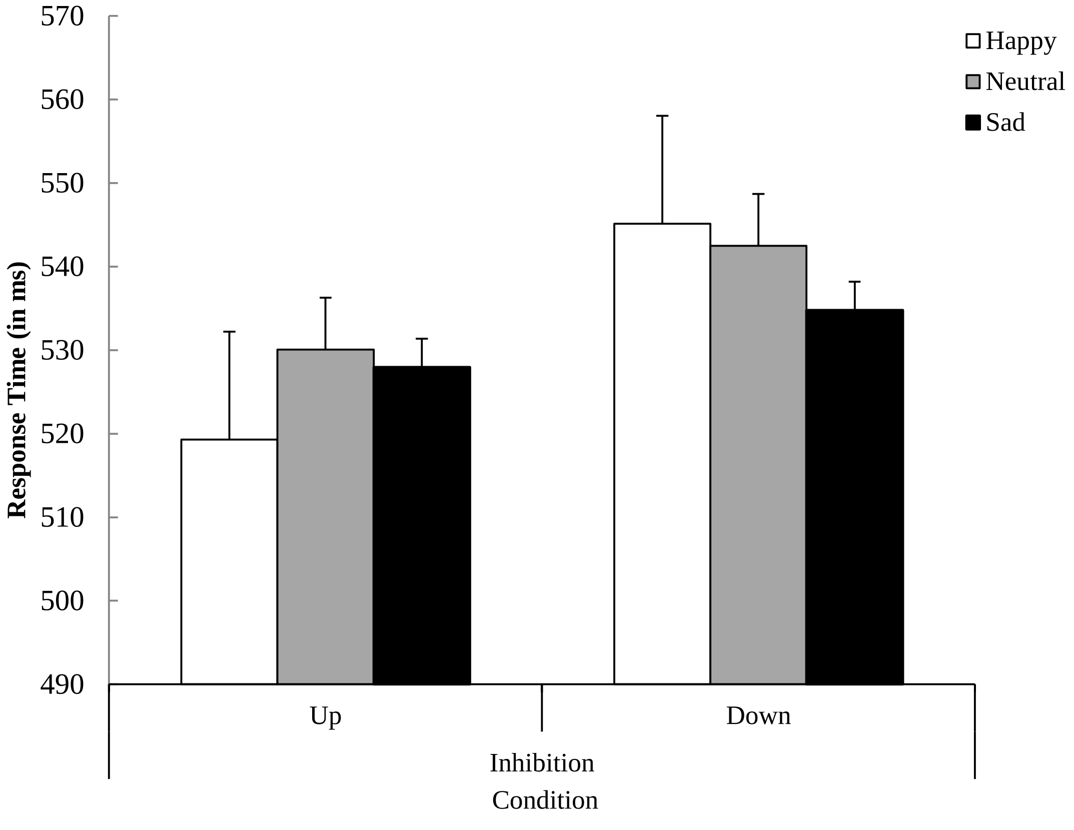

Figure 1. Response time to neutral targets in up or down positions after the appearance of happy, neutral, or sad faces in the inhibition straw condition.

In the inhibition straw condition, participants were significantly faster to respond to targets in the up position than the down position after they were presented with a happy face, t (34) = -3.886, $p < 0.05$ or a neutral face t (34) = -2.074, $p < 0.05$. It was expected that participants would respond faster to targets preceded by a happy face, however there was not a significant main effect for Valence, $F(1, 106) = .176$, $p > 0.05$. There were no other significant main effects or interactions.

Discussion: Experiment 3

The focus of this experiment was to investigate whether the presentation of photographic images of emotionally expressive faces leads to attentional biases that are consistent with metaphor, and also to investigate what effect disrupting automatic facial mimicry responses would have on spatial attention and response times to neutral targets. It was expected that attentional biases would be observed that were consistent with orientational metaphors. This hypothesis was partially supported by the results. There was a significant interaction between Condition, Position, and Valence. The interaction was driven by the inhibition smiling condition. In this condition, there was a significant difference between response times to targets in the up position and the down position that were preceded by a happy face. Participants were significantly faster to respond to targets in the up position after the presentation of a happy face and slower in the down position. This result was also replicated for targets preceded by a neutral face: particpants were faster to respond to targets in the up position than the down position – a result that was not predicted. It was also expected that if metaphor-consistent attentional shifts occurred they would be bi-directional (i.e. faster response times for targets in the down position than the up position that were preceded by a sad face), however there was no significant difference between response times to targets in the up/down positions after the presentation of a sad face. These differences only occurred in the inhibition condition and were not found in the control or smiling facilitation conditions.

It was also found that participants were faster to respond to targets when they went through the response task without a straw. This result is of particular interest because it did not occur in Experiments 1 and 2, even though the straw techniques used across all three experiments were identical. Studies have shown that increasing the number of simultaneous tasks that are performed slow response time. However, if the present results were just an effect of increased task demand then response times would have been slower for the straw conditions across all three experiments. Human beings are highly adept at processing facial expressions (Posamentier & Abdi, 2003), and as outlined previously in this research the processing of faces may involve subtle mimicry of the expression (Dimberg & Karlsson, 1997; Dimberg & Thunberg, 1998). Niedenthal and colleagues (2001) found that participants were slower to detect the change in expression of a morphing face when they were asked to perform a facial motor task similar to the inhibition smiling task used in this experiment. They argued that this was due to the disruption of automatic facial mimicry processes. The addition of either straw technique may have interfered with this processing leading to slowed response times for targets preceded by the images of faces.

Participants were also faster to respond to targets in the up position across all three conditions. Lovegrove (2009) and Moshenrose (2010) also found an upward bias to neutral targets. A potential reason why this bias was found may have been related to participant mood. Wapner and colleagues (1957) found that individuals induced into a positive emotional state exhibited an upward bias when performing a bisection task and a downward bias if they were induced into a negative emotional state. Mood was not measured in this study, so it remains unknown whether it had an influence over the results. This could be accounted for by including a measurement of mood before and after the experimental task.

It is also possible that attentional gaze was directed towards the eyes of the images. Researchers have argued that we determine where another individual’s attention is directed by combining information about eye gaze and head/body orientation. The eyes in particular provide a powerful signal about the direction of the observed individual’s attention (Langton, Watt, & Bruce, 2000). Research conducted by Langton et al. (2000) indicated that even unintentional cues from eye gaze can produce shifts in visual attention from the observer. The photographs in Experiment 3 were chosen to ensure that the individuals portrayed were looking straight ahead. However, in the sad and neutral images of both faces the iris sits above the centre line of the eye (see Appendix C). It is possible that due to this, spatial attention may have inadvertently been shifted upwards.

Based on the previous two experiments, it was expected that overall participants would respond to targets faster that were preceded by a happy face. This expectation was not supported by the results of Experiment 3. It is possible that this result was not found for Experiment 3 because the schematic faces used in Experiments 1 and 2 were more symbolic of a happy expression. The schematic faces used in Experiments 1 and 2 had large, U-shaped mouths that are representative of a happy expression, but are uncharacteristic of an actual expression of human happiness. The use of the happy schematic faces in Experiments 1 and 2 may have led to faster response times to neutral targets because the facial expressions in these experiments were less ambiguous and more symbolic of happiness than the happy expressions in Experiment 3.

It was also expected that inhibiting and facilitating smiling would impact response times – specifically that participants would be faster to respond to targets in the up position in the facilitation smiling condition and in the down position in the inhibition smiling condition. However, these expectations were not supported. The results of Experiment 3 are discussed in greater detail in the next section.

General Discussion

The purpose of the current research was to investigate whether spatial biases occur after the presentation of sad and happy faces that are consistent with orientational metaphors (i.e. positive = up, negative = down). A tenet of the research was that if these spatial biases were to occur then on a subtle physical level the observer would mimic the expression (Dimberg & Karlsson, 1997; Dimberg & Thunberg, 1998) and embody the emotion that was displayed from the face (Niedenthal, 2007). The research also aimed to investigate what would happen when automatic facial mimicry responses were disrupted. Participants across all three experiments were asked to either hold a straw between their lips, to inhibit smiling, between their teeth, to facilitate smiling, or perform the task without a straw.

It was expected that the presentation of a happy face would shift attention upwards and targets in a high vertical position would be responded to faster, whereas the presentation of a sad face would shift attention downwards and targets in a low vertical position would be responded to faster. These hypotheses were not supported by the results of Experiments 1 or 2. They were partially supported by Experiment 3. Targets in the up position were responded to faster than targets in the down position when they were preceded by a happy or neutral face. For Experiment 3, it was expected that spatial biases that were consistent with metaphor would be evident in the no straw condition, but these would be disrupted in the conditions in which smiling was inhibited or facilitated with a straw. However, the only spatial biases that occurred were in the inhibition smiling condition.

Lovegrove (2009) found a similar result to Experiment 3. Targets in a high vertical position were responded to faster after the presentation of a happy schematic face. In the current research, this shift in attention was not found for schematic faces (Experiments 1 and 2). It was argued that this shift potentially did not occur because the schematic faces used in Experiment 1 contained fewer internal features than the faces used in Lovegrove’s (2009) study. However, even with the addition of internal schematic facial features (Experiment 2) there were no attentional biases. A possible reason why there is a discrepancy between Lovegrove’s results and the results of the first two studies of the present research is that the faces used in Lovegrove’s experiment had four lines on the top of the face to represent hair.

These lines pointed upward and may have directed gaze upwards creating a spatial bias for the high vertical position. Consequently, those results may have been a reflection of the upward bias as opposed to metaphoric representation of affect.

The results from Experiment 3 were unexpected. An expectation for the inhibition condition was that attention would be shifted downward because smiling was inhibited by holding a straw between the lips. This particular technique does not actually activate the facial musculature that is associated with expressions of negative affect such as sadness or despair (Niedenthal et al., 2001; Oberman et al., 2007). It does however inhibit the natural movement of orbicularis oculi pars, the muscle surrounding the eye. The orbicularis oculi pars muscle is responsible for blinking (Rogers et. al, 2009). This type of muscular inhibition may have led to greater focal attention because of decreased blinking in participants. If the presentation and evaluation of real happy faces shifts attention upward then the inhibition condition of Experiment 3 may have been a more direct measurement of this. The results of Experiment 3 provide some evidence that the presentation of real faces with happy expressions shifts attention in a manner that is consistent with orientational metaphors (happy = up).

A possible explanation as to why the results of the inhibition condition in Experiment 3 were not replicated in the other experiments may be due to participant gaze. If spatial biases were produced up or down after the presentation of a valenced face (real or schematic), then the length of time each face was presented (500ms) may have been long enough for participants to shift their gaze to another part of the computer screen. Furthermore, there may have been some extraneous head movements and spatial exploration that influenced spatial attention. These potential issues could be accounted for in future investigations by using head restraints, or chin holders to decrease extraneous head movement. It may also be beneficial to use eye-tracking technology to precisely measure attentional gaze (Karatekin, 2007). By using this technology, it would ensure that gaze was centred appropriately and consistently at the beginning of each trial. It would also provide a better account of any vertical spatial biases that may arise.

Another possible explanation that metaphor-consistent spatial biases were not found in the majority of this study, may be that it is not enough to simply perceive a happy or sad expression, but the observer actually needs to evaluate the stimuli in emotionally valenced terms. Niedenthal, Winkielman, Mondillion, and Vermeulen (2009) asked participants to evaluate whether concrete (i.e. baby, slug) or abstract objects (i.e. joyful, anger) were associated with an emotion. They found that during the brief time it took participants to evaluate a word as emotional or non-emotional they expressed the associated emotion themselves (i.e. expressing disgust when presented with the word "slug"). However, when another group of participants was asked to make judgements about whether the words were written in capital letters this embodiment of expression did not occur. Niedenthal and colleagues (2009) argued that embodiment of emotion is a necessary factor for emotional judgements but is not necessary for perceptual judgements. It is possible that this holds true for the evaluation of faces as well. The participants in the current study perceived faces, but their primary task was to respond to neutral targets. They were not required to make any evaluative judgements about the emotions of the faces presented. Consequently, they may not have embodied the expressed emotion. To clarify this, future investigations could replicate the no straw conditions from this study and ask participants to perform the response task and simultaneously evaluate the facial expression presented. For example, asking the participants to say in their head or out loud whether the expression they saw was sad, happy, expressionless, etc.

It is also possible that the fast presentation (500ms) of contradictory expressions (happy and sad) throughout the current studies may have interfered with automatic facial mimicry responses. Meaning that if facial mimicry responses of emotional expressions lead to attentional biases these may have also been disrupted. In Dimberg and colleagues' (2000) research they exposed participants to emotionally valenced faces for only 30ms and found that participants still mimicked the facial expression presented. However, only one emotion was presented per condition, with one group of participants presented with happy faces and another group presented with angry faces. Consequently, another way future research could measure metaphor-consistent attentional biases is by using a between groups design.

To sum up what has been discussed so far, it was expected that spatial biases would arise that were consistent with orientational metaphors (happy = up, sad = down). However, these attentional biases did not arise in Experiments 1 and 2. In the inhibition smiling condition of Experiment 3, response times were faster for targets in the up position than the down position when preceded by a happy face. This provides partial support that faces may be evaluated in a manner that is consistent with orientational metaphors (Meier and Robinson, 2004; 2006), but future research is needed to clarify this.

This research also investigated what impact disrupting facial mimicry and embodied emotion responses would have on spatial attention. It was expected that participants who inhibited smiling would exhibit downward spatial biases and respond faster to targets in the low vertical position, whereas participants in the facilitation smiling conditions would exhibit upward spatial biases and respond faster to targets in the high vertical position. It was also expected that response times would be faster for targets preceded by a face that was congruent with the facial manipulation (i.e. happy face in smiling facilitation condition) and slower for targets preceded by an incongruent face (i.e. happy face in smiling inhibition condition). The results of this research did not support these expectations.

There are several possible explanations for these findings. As previously discussed, it is possible that merely perceiving images of valenced faces is not enough to elicit facial mimicry and the embodied emotional response (Niedenthal, 2009). Subsequently, if facial mimicry responses were not actually elicited then attempts to disrupt facial mimicry, by inhibiting or facilitating smiling, would have had no impact.

The results of this research were inconsistent with the notion that inhibiting smiling would create a downward bias. Previous studies that have recorded downward spatial biases have induced participants into negative emotional states (Wapner et al., 1957) or used participants that already had high levels of negative affect or depression (Meier and Robinson, 2006). Research has shown that the smiling inhibition technique used in this research is effective in reducing evaluations of positive stimuli (Moshenrose, 2010; Stepper & Strack, 1988). However, an emotional expression of negative affect, such as sadness, is not actually elicited by the inhibition smiling technique (Oberman et al., 2007). A possible explanation for the present results is that because negative affect was not actually induced a downward bias was not evident.

Like the inhibition smiling technique, the facilitation smiling technique may not have actually induced positive affect. The technique used in this research elicited what is known as a non-Duchenne smile. A Duchenne smile involves the contraction of both the zygomaticus major muscle (mouth corners raise) and orbicularis oculi muscle (cheeks raise), whereas the non-Duchenne smile only involves the contraction of the zygomaticus major muscle (Soussigan, 2002). Duchenne smiles have been shown to be more indicative of genuine, spontaneous emotional responses than other smiles (Ekman, Friesen, & O’Sullivan, 1988). Soussigan (2002) found that individuals asked to display a Duchenne smile rated positive stimuli as more positive and enjoyable than individuals who were asked to display a non-Duchenne smile. It is possible that the smiling facilitation technique that was used in this research did not actually lead to the embodiment of positive affect, and consequently the upward bias that was predicted during the facilitation smiling conditions did not arise.

The issues discussed above also provide possible explanations as to why response times for targets preceded by congruent and non-congruent stimuli did not differ across the studies. If the facial manipulations were not strong enough to elicit embodied emotion then the evaluation of affective stimuli (the faces) may not have been impacted.

However, the inhibition and facilitation smiling techniques used in this research have been used effectively in previous research (Moshenrose, 2010; Niedenthal, 2001; Soussigan, 2002; Stepper, Martin, Strack, 1988). It is possible that the techniques were effective for inhibiting and facilitating smiling, but the expected results were not gained due to participant fatigue. The length of the experiments in this research were comparative to other research that has investigated vertical attention and orientational metaphors (Meier & Robinson, 2004; Meier & Robinson, 2006), but may have been too long for embodied emotion responses. Future investigations could examine this by reducing the number of trials presented in each condition or breaking up the trials into blocks with short breaks in between each block.

The findings of this research offer some support that valenced facial expressions are processed in a way that is consistent with metaphor. Despite its limitation, it adds to the growing body of research on the evaluation of affective stimuli and metaphor. It is not conclusive that seeing a happy face means “seeing up”, but this research provides a foundation for future investigations into this area. It also contributes to our understanding of how schematic and real faces are processed and whether merely perceiving faces leads to responses of embodied emotion.

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Appendix A - Experiment Materials Used Across All Experiments

Straw Techniques**:** The following photos depict the straw techniques that were used across all three experiments.

Image 1: Smiling inhibition technique

Image 2: Smiling facilitation technique

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Information Sheet: research teams with data for various uses

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What is the purpose of this research?

- This research will investigate how people's spatial attention is impacted when evaluating faces and performing a facial motor task.

Who is conducting the research?

- Sara Moshenrose is conducting the research for her Master's Thesis in Psychology. Dr. John McDowall is supervising this project. This research has been approved by the University ethics committee.

What is involved if you agree to participate?

- If you agree to participate in this study, you will be shown happy and sad faces on a computer screen and then asked to identify letter targets (p, q) as fast and as accurately as possible. You will also be asked to simultaneously perform a facial motor task which involves holding a straw in your mouth.
- We anticipate that your total involvement will take no more than 30 minutes.
- During the research you are free to withdraw, without any penalty, at any point before your data have been collected.

Privacy and Confidentiality

- We will keep your consent forms and data for at least five years after publication.
- You will never be identified in our research project or in any other presentation or publication. The information you provide will be coded by number only.
- In accordance with the requirements of some scientific journals and organisations, your coded data may be shared with other competent researchers.
- Your coded data may be used in other, related studies.
- A copy of the coded data will remain in the custody of Dr. John McDowall

What happens to the information that you provide?

- The data you provide may be used for one or more of the following purposes:
  - The overall findings may be submitted for publication in a scientific journal, or presented at scientific conferences.
  - The overall findings may form part of a PhD thesis or Master's Thesis that will be submitted for assessment.

If you would like to know the results of this study, they will be available approximately October 2010. They will be posted on the 4th floor noticeboard area of the Easterfield building.

Statement of consent

I have read the information about this research and any questions I wanted to ask have been answered to my satisfaction.

I agree to participate in this research. I understand that I can withdraw my consent at any time, without penalty, prior to the end of my participation.

Name: ___________________________________

Signature: ___________________________________

Date: ___________________________________

Student ID: ___________________________________

Age: ___________________________________

Gender: ________

Debriefing Statement

Thank you for participating in this experiment.

This study examined whether facial manipulations, such as smiling and frowning, paired with viewing happy and sad faces produces significant shifts in attention either upwards or downwards.

Previous research has shown that evaluations of words and faces can bias attention up or down. Research has indicated that vertically biased attention may be linked to spatial metaphor – where positive things are up and negative things are down. Statements such as "I'm feeling down" or "My hopes soared" are common in our everyday language. Other research has shown that if an individual views a smiling face they will respond faster to a target in an upward position (Lovegrove, 2009). Studies have shown that emotionally charged information is processed faster if an individual is embodying a similar emotion. For example, Strack, Martin, and Stepper (1988) found that if individuals were made to smile they responded faster to positive stimuli, and if they were made to frown they responded faster to negative stimuli.

The purpose of this research is to combine the previous literature, and investigate if individuals show spatial biases (up or down) when asked to perform a facial motor task and view happy and sad facial expressions. In this study, there were three separate groups. Groups were asked to hold a straw between their teeth (to facilitate smiling), between their lips (inhibit smiling), or they were given no straw at all. All participants were asked to view happy and sad faces and then identify targets. It is predicted that individuals in the smiling group will react to targets faster when they are shown a happy face on the screen and the target is in an upward position. The same results are expected for the non-smiling group, except reaction times to targets will be faster when they are shown a sad face and the target is in a downward position. It is also expected that if the facial motor task does not match the facial expression shown on the screen (i.e. participant smiling, shown sad face) reaction time to targets will be slower.

This research will give further insight into how both external and internal emotional information impacts our spatial attention. This research may be very important to clinicians and researchers interested in non-invasive treatments for individuals with mood disorders. Does looking up really mean feeling up?

If you would like more information about spatial metaphor and attention, you may want to consult: Meier, B. P., & Robinson, M. D. (2004). Why the sunny side is up: Associations between affect and vertical position. *Psychological Science*, *15*(4). Further information regarding embodying emotions through facial manipulation can be found in: Niedenthal, P. M (2007). Embodying emotion. *Science, 316*.

Thank you again for participating in this research. If you have any further questions please contact Sara Moshenrose at sara.moshenrose@vuw.ac.nz.

Appendix B – Experiment One Stimuli

Schematic faces used in target response task.

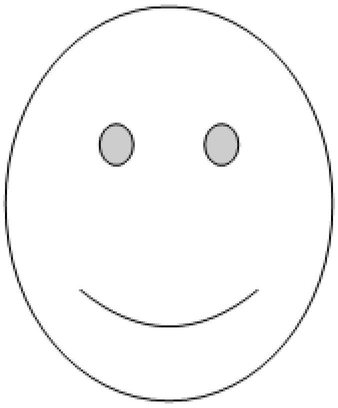

Image 1: Happy Face

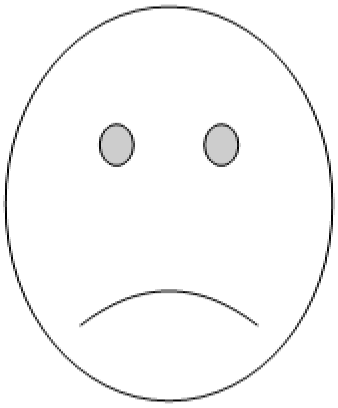

Image 2: Sad Face

Appendix C – Experiment Two Materials

Schematic faces used in target response task.

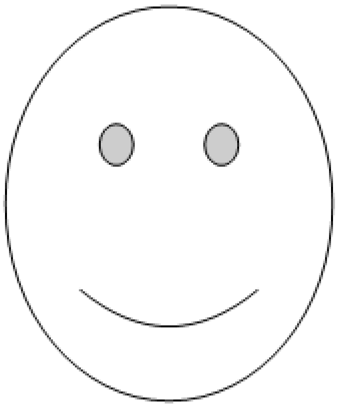

Image 1: Happy face

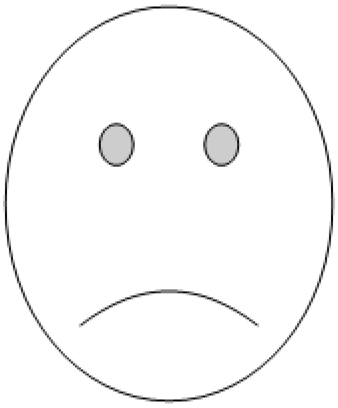

Image 2: Sad face

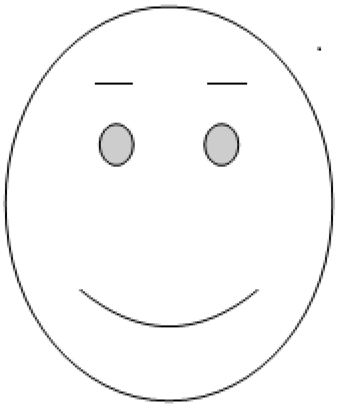

Image 3: Happy face with eyebrows

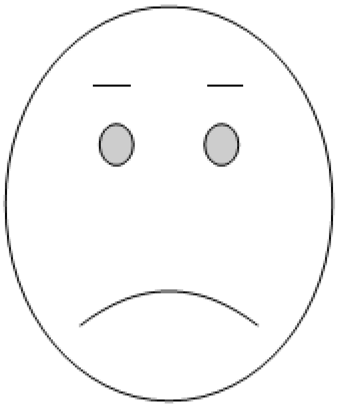

Image 4: Sad face with eyebrows

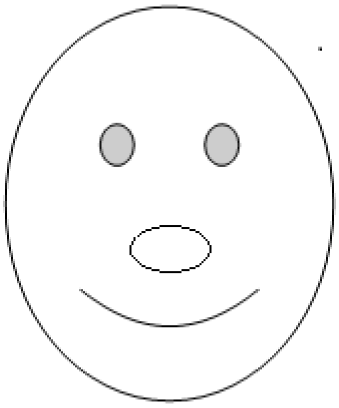

Image 5: Happy face
with nose

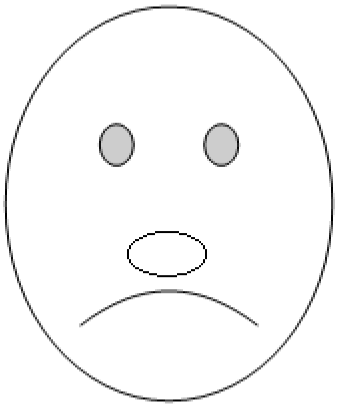

Image 6: Sad face with
nose

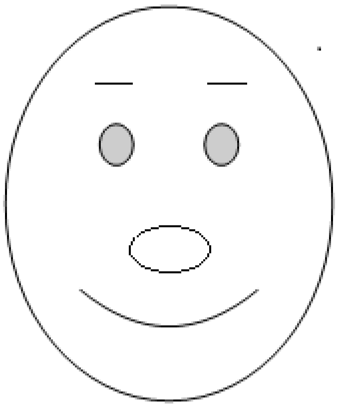

Image 7: Happy face
with nose and eyebrows

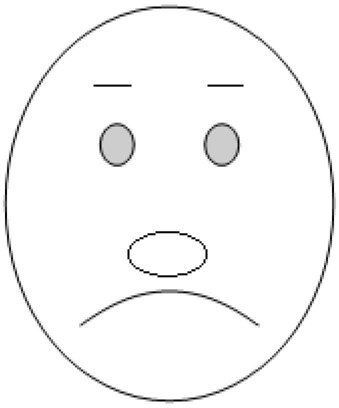

Image 8: Happy face
with nose and eyebrows

Appendix D – Experiment Three Materials

Photographic images used in target response task.

Image 1: Female happy face

Image 2: Male happy face

Image 3: Female neutral face

Image 4: Male neutral face

Image 5: Female sad face

Image 6: Male sad face