The Effect of Valence and Arousal on Spatial Attention

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Abstract

Conceptual metaphor theory suggests that to mentally represent abstract concepts we use metaphorical associations to map them onto more concrete constructs (Lakoff & Johnson, 1980; 1999). Using a choice reaction time (CRT) task, Meier and Robinson (2004) found that positively valenced words primed attention to higher areas in vertical space, while negatively valenced words primed attention to lower areas in vertical space, consistent with the *good is up*/*bad is down* conceptual metaphor. Meier and Robinson (2004; 2005) suggest this provides evidence that emotional words create an automatic and obligatory metaphor-congruent shift in spatial attention, driven by a Valence x Position interaction. However, other research shows that the arousal level, not just the valence of emotional words can affect reaction time (Robinson, Storbeck, Meier & Kirkeby, 2004). This means concluding that valence alone is driving the shift in attention is premature. Furthermore, Brookshire, Irvy and Casasanto (2010) dispute Meier and Robinson's claim that the relationship between affect and metaphor is automatic, instead suggesting that affect-metaphor associations are optional and only accessed under certain contextual conditions. The purpose of this thesis was therefore two-fold. First, it aimed to explore whether valence, arousal, or an interaction between the two was responsible for driving the metaphor-consistent shift in spatial attention observed by Meier and Robinson (2004). Second, it aimed to progress the discussion about when affective stimuli, in the form of emotional words, automatically activate the *good is up*/*bad is down* conceptual metaphor. Three CRT experiments were conducted in which (a) emotional stimulus words were differentiated by arousal level as well as valence and (b) the evaluation of stimulus words' affective tone (pleasant/unpleasant) was manipulated. A Valence x Position interaction in relation to the *good is up* but not *bad is down* conceptual metaphor was found when the valence of priming words was evaluated, suggesting valence, rather than arousal or a combination of both, is driving the affect-metaphor relationship. No evidence for the automatic activation of affect-metaphor associations was found when the word's affective tone was not evaluated. These findings suggest that while driven by valence, affect-metaphor associations are not fully automatic and occur only under certain contextual conditions. The implications for our understanding of how emotion impacts spatial attention are discussed, suggesting metaphors enrich, rather than monopolise our mental representation of abstract, affective concepts.

Keywords: conceptual metaphor theory, spatial attention, valence, arousal

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Metaphors describing abstract concepts in terms of more concrete ideas are pervasive across language, culture and time. Their value has been debated by philosophers and linguists for centuries (Gibbs, 1994, 2011; Meier & Robinson, 2005). However, there is a growing and increasingly compelling body of research supporting the idea that conceptual metaphors are not just linguistic tools, but cognitive tools that shape how we think. Over the last decade in particular, a number of behavioural studies have emerged that suggest abstract concepts such as power, interpersonal intimacy, divinity and ‘goodness’ are mentally represented, through metaphorical associations, in more concrete, physical terms (Brookshire, Ivry, & Casasanto, 2010; Casasanto & Boroditsky, 2008; Chen & Bargh, 1999; Giessner & Schubert, 2007; Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007; Meier & Robinson, 2004; Meier & Robinson, 2006; Meier, Robinson, & Clore, 2004; Meier, Robinson, Crawford, & Ahlvers, 2007; Schubert, 2005).

In one such study, ‘The sunny side is up’, Meier and Robinson (2004) found evidence for an intriguing relationship between affect and attention in vertical space. Using a choice reaction time (CRT) paradigm, they found that when a positively valenced word (e.g. ‘brave’) was presented in the upper portion of a computer screen, subjects were faster to evaluate the word as ‘pleasant’ than if it was presented in the lower portion of the screen. Conversely, when the target word was negatively valenced (e.g. ‘bitter’), subjects were faster to evaluate the word as ‘unpleasant’ when it appeared in the lower portion of the screen. Together with results from earlier work, Meier and Robinson concluded their findings provided evidence that attention to higher and lower areas of vertical space can be ‘activated’ by evaluating a positively or negatively valenced word. The foundation for this, they argue, is conceptual metaphor theory and the activation of the *good is up*/*bad is down* spatial metaphor. Faster response times occur because emotional words ‘prime’ the metaphorically congruent area of vertical space.

While evidence for the ability of metaphor to drive spatial attention is mounting, what remains unclear is first, whether it is specifically word valence that is driving that attentional shift and second, whether those metaphorical associations are accessed automatically. The purpose of this thesis is to progress the discussion about how and when affective stimuli, in the form of emotional words, automatically activate the *good is up*/*bad is down* conceptual metaphor. The first question that will be posed is whether it is the valence of emotional words, their arousal level or a combination of the two that trigger the activation of an affect-metaphor association. There is growing evidence that affective experiences are not unitary and can be categorised across two distinct dimensions: valence and arousal (Brunyé, Mahoney, Augustyn, & Taylor, 2009; Kensinger, 2004). The valence of an experience can range from highly positive to highly negative. Quite independently, a positive or negative experience can be either highly arousing (i.e., exciting or agitating) or non-arousing (i.e., calming or soothing). Extensive evidence suggests the arousal level of a stimulus, not just its valence, acts to direct attention (Fernandes, Koji, Dixon, & Aquino, 2011; Gable & Harmon-Jones, 2010; Gianotti et al., 2008; Heller, 1993; Jefferies, Smilek, Eich, & Enns, 2008; Keil & Ihssen, 2004; Kensinger, 2004; Loftus, Loftus, & Messo, 1987; Purkis, Lipp, Edwards, & Barnes, 2009; Robinson & Compton, 2006; Sakaki, Niki, & Mather, 2012; Storbeck & Clore, 2008). For example, Kensinger (2004) proposes that while items that are highly arousing benefit from ‘prioritised attention’, positive and negatively valenced stimuli that are non-arousing do not receive this prioritised attention. Furthermore, Robinson, Storbeck, Meier and Kirkeby (2004) found a Valence x Arousal interaction in the speed of evaluative processing of both emotional words and pictures. The stimulus words used in Meier and Robinson (2004) were categorised by valence, but not on the basis of arousal. It is therefore important to establish whether the metaphor-affect linkage is driven by valence, arousal or a Valence x Arousal interaction when arousal, as well as valence is controlled for and manipulated to act on attention.

The second question posed by the current study is whether an association between affect and metaphor is automatically activated on viewing an emotional word, or whether it is only activated in certain circumstances, such as when the affective tone of the word is evaluated. Meier and Robinson (2004, 2005) argue that their study provided evidence for the obligatory activation of metaphor-affect linkages because participants made metaphorically consistent responses in the absence of a cue to signal that vertical position and valence were connected. However, Brookshire et al., (2010) have argued verticality is very salient in the Meier and Robinson (2004) task because the target shifted from high to low position from trial to trial. Furthermore, participants made active judgements about the valence of the word, potentially drawing attention to both the source domain (verticality) and the associated target domain (affect). Consequently, while these experiments provide evidence for a metaphor-affect linkage, they may not provide conclusive evidence for an automatic or obligatory relationship between metaphor and emotion.

An alternative view to that of Meier and Robinson (2004) is that activation of metaphorical connections to structure thinking around affective concepts is context dependent rather than obligatory (Brookshire et al., 2010; Godfrey, 2011; Landau, Meier, & Keefer, 2010). In this view, metaphors enrich, rather than monopolise the way in which we think about affect. The question therefore shifts from ‘whether’ metaphors are used to help us think abstract thoughts to asking under what conditions metaphors guide abstract thought (Brookshire et al., 2010; Murphy, 1996). For example, Brookshire et al., found evidence for the automatic activation of spatio-motor representations of the *good is up*/*bad is down* metaphor using a speeded button press task in response to positively and negatively valenced words. However, this effect reduced when target words were repeated multiple times, and when attention was directed away from word meaning and toward the colour in which the word was written. In another study, Godfrey failed to replicate the findings of Meier and Robinson when spoken, rather than written, emotional words were used as the stimulus in a CRT task. This suggests that whether emotional words automatically activate metaphor-congruent shifts in attention is affected by the mode of presentation – aural or written.

The second purpose of this study is therefore to test the boundary for the automatic activation of affect-metaphor associations, by manipulating the degree to which the stimulus words are evaluated for positive or negative meaning. This extends the work of Brookshire et al., (2010) but within the word-cueing paradigm originally used by Meier and Robinson (2004). If the metaphor-affect linkage was indeed obligatory, its effect should be apparent even without a full, explicit evaluation of word meaning. Neely and Kahan (2001) suggest that unless a word appears in such a way that visual feature integration is impaired, words automatically activate their semantic meaning, regardless of intention or the quality of attentional resources allocated to the task. With this definition in mind, if the affect-metaphor link is automatic, explicit evaluation should not be required in order to activate the metaphorically consistent attentional shift. Brookshire et al., (2010) have demonstrated that when attention is drawn toward perceptual features of a word, the effect of metaphoric representation is reduced. What remains to be tested is whether the metaphor-affect linkage is activated when evaluation of the emotional word is possible, but not required.

In the space of this thesis, I will first explore general theories that guide thinking in relation to selective attention, together with evidence for symbolic control of attention in vertical space. Support for the notion that words can overtly or covertly act as symbols to direct attention in physical space will then be discussed. Second, the concept of metaphor will be introduced and the theory underlying how metaphor might, when activated through words, direct attention in vertical space will be explored. Third, evidence in support of the distinct roles of valence and arousal as dimensions of affect will be discussed. Supporting theories suggesting different ways in which attention may be influenced as a result of emotional stimuli will also be canvassed. Fourth, the arguments surrounding the automatic and obligatory activation of metaphor-affect interactions will be outlined in more depth. Lastly, on the basis of this foundation, the current study will be outlined.

Framework - Selective Attention

If we were to attend equally to all information in our visual realm, it could have significant negative consequences for our ability to process incoming information efficiently and might even compromise our chances of survival. Consider for a moment the following scene: You are walking through the jungle. In front of you – not 10 feet away – appears a tiger. Its eyes are trained on you and its body is poised to pounce. Your attention shifts. No longer are you admiring the green of the leaves of a nearby tree, in fact you hardly notice the tree is there. Your attention is fully focused on the large hostile form in front of you and working out how to get away. Were you to keep your attention on the wider scene – paying equal attention to the tiger as you did to the leaves on the trees, a butterfly perched nearby or a passing worm – it would likely increase the tiger's chances of a decent meal in the not too distant future. In this very concrete example, the negative valence of the tiger and the high level of arousal generated by its close proximity serve to change the focus of attention.

Human attention can be conceptualised as a limited-capacity system (Ristic & Kingstone, 2009). Consequently, humans 'economise' attention, giving priority to the processing of information perceived to be important (Oakley, 2009) – such as the tiger in the example above. One of the tools our central attentional system uses to help select information for priority processing is 'cues'. In terms of visual attention, cues can indicate the likely location of a signal in visual space and serve to orient attention for subsequent information. There is evidence right down to a cellular level that when a subject is given a cue about the likely location of a subsequent signal, early electrical activity in the brain (<100ms) is enhanced (Posner, Snyder, & Davidson, 1980). As well as orienting attention in visual space, cues facilitate detection – the speed at which a subject notices a signal and acknowledges this by way of a response, such as pressing a key on a keyboard. Using a reaction time task, Posner et al., (1980) found that when the location of a letter was cued to an expected location, reaction times were significantly faster than when a cue was incongruent with location.

Posner (1980) described this focus of attention as like a ‘spotlight’ that enhances processing in a given region of space. Eriksen and St. James (1986) developed this further, suggesting a zoom-lens model, with an area of high focus, degrading to more fuzzy representations at the edge of the attentional field. Referring specifically to spatial attention in the context of cuing tasks, Johnston, McCann and Remington (1995) suggest cuing creates a movable ‘attentional window’. They propose this window acts as a filter, shifting attention to the location where priority processing is desirable. This ‘window’ may be activated by reflexive, external orienting, like turning in the direction of a sudden movement in peripheral vision. It can also be activated by volitional, goal-driven orienting, such as checking for traffic before crossing the road (Berger, Henik & Rafal, 2005; Green & Woldorff, 2012). While both these examples involve the movement of the eyes (and even the head), it is important to note that attention can be adjusted independently of eye saccades or broader bodily movements (Posner et al., 1980). Though the analogies differ between the ‘spotlight’, ‘zoom-lens’ and ‘attentional window’ models, the underlying theory is the same - that attention across visual space is not equal. A range of external and internal forces mean some parts of visual space will receive greater priority for processing than others.

Evidence for symbolic control of attention. There is ample evidence that humans reflexively orient to salient events such as the appearance of bright lights or sudden movements in the periphery (Berger et al., 2005; Posner, 1980; Posner et al., 1980). There is also a significant body of evidence that suggests people consciously interpret certain cues or symbols within our environment in a way that shifts their attentional window or spotlight (Henderickx, Maetens, & Soetens, 2010; Posner et al., 1980).

Arrows are among the strongest symbols that influence control of visual attention. For example, Hommel, Pratt, Colzato and Godjin (2001) conducted a series of experiments in which participants responded to spatially unpredictable targets. Despite being instructed to ignore centrally presented task-irrelevant arrows, participants responded faster when target objects appeared in a location that was compatible with the direction suggested by the arrow cue. Green and Woldorff (2012) describe arrows as highly overlearned stimuli that automatically trigger orientation, in a way similar to peripheral cues such as bright lights or sudden movements. Ristic and Kingstone (2009) suggest that arrows have both an automatic and a voluntary effect on orienting. They measured the magnitude of effect of three types of cue: unpredictive arrows; numbers that participants were taught to be predictive (e.g. '1 = left, 2 = right'); and predictive arrows. Predictive arrows enhanced the speed of responding to the subsequent target more than the unpredictive arrows and the learned predictive numbers combined. Arrows can therefore be described as 'super-orienters', working to influence spatial attention on both an automatic and a conscious controlled level (Ristic & Kingstone, 2009).

Words as symbols. Direction words can also trigger rapid shifts of attention. Hommel, Pratt, Colzato and Godjin (2001) found that when the words "up", "down", "left" and "right" were presented at the fixation location, they caused shifts in attention that impacted performance on three different kinds of attentional task – a detection, inhibition of return and choice decision task. They concluded that directional words, like arrows, are symbolic and therefore 'meaning-based' and once 'over-learned', can operate at an automatic as well as a controlled level to influence attention.

As well as words that are overtly congruent with a given direction, words that are linked 'by association' with positions in vertical space may also influence attention. According to the spatial registration hypothesis, language processing and perceptual experiences are intimately linked. This hypothesis proposes that to understand words, it is necessary to reactivate the associated perceptual experiences (Coslett, 1999; Fischer & Zwaan, 2008; Šetić & Domijan, 2007). Arguably, linking an item with its location in the environment has a sensible evolutionary basis. Finding food and avoiding threatening creatures is made much simpler if you know where they are typically found (Coslett, 1999). Using this hypothesis, when we learn a new word, we associate that word with sensory properties, including its usual position in visual space. Words prime these spatial associations, meaning that when we retrieve the word, we also retrieve its usual spatial association (Estes, Verges, & Barsalou, 2008). For example, when we learn the word ‘hat’, we associate it with a higher position in visual space than the word ‘shoe’, as hats are most often seen on a person’s head while shoes are found on people’s feet.

Setic and Domijan (2007) sought to test out this relationship between spatial processing and lexical decision making. First, they used terms that related to animals that could fly and animals that are usually found on the ground. Animal names were presented on a computer screen and participants were asked to decide if the animal could fly or not fly. Reaction times (RTs) were faster when there was congruency between the usual location of the animal in visual space and the position of the word relating to that animal on the screen. That is, RTs were faster for animals that are usually found in the sky (e.g. eagle) when they were located at the top of the computer screen and for animals that are usually found on the ground (e.g. rabbit) when they were located at the bottom of the computer screen. In a second experiment, they found the results held, even when applied to a combination of living and non-living entities and the task decision (living or non-living) was not linked to spatial position. Words that were implicitly linked to higher positions in visual space (e.g. aeroplane) were processed faster when they appeared at the top of the computer screen, while words that were linked to lower positions (e.g. basement) were processed faster at the bottom of the screen. Similarly, Pecher, Dantzig, Boot, Zanolie and Huber (2010) conducted a ‘sky decision’ and an ‘ocean decision’ task using objects that are associated with one of these two locations (e.g. helicopter, shark). Like Setic and Domijan (2007), they found that responses were faster when the object appeared in a location that matched a mental simulation of the object’s meaning. For example, the mean response to the word 'helicopter' was faster when it occurred at the top of the screen. The key finding from both of these studies is that they offer support for the idea that the spatial position of objects is automatically encoded when we encounter them in the world and that when we retrieve the word, we retrieve its spatial location, regardless of whether that is relevant to the task at hand. This appears to guide attention to an area of visual space that is congruent with its overt or implicit symbolic meaning, through perceptual simulation of associated sensory-motor information.

Theoretical foundation for the perceptual simulation approach. The idea that mental simulation is an integral part of memory processes is not without controversy. Though perception sat at the core of theoretical understanding of cognition for two millennia, the rise of behaviourism and amodal information processing models saw the pendulum swing away from a perception-as-central approach (Barsalou, 1999). The amodal approach suggests that conceptual representations that form part of schemata, semantic networks and the like are completely independent of the perceptual states that created them. A perceptual event, however striking in a sensory manner, is coded into symbols that are stored for use in thought and language in a way that has no analogical relationship to the original experience. Emotional concepts such as anger are therefore mentally represented in the same way that we conceptualise everyday objects such as a car – as a set of abstract symbols (Winkielman, Niedenthal, & Oberman, 2009).

The pendulum now appears to be returning toward a position which acknowledges modal forms of representation as well. Embodied accounts of cognition contend that cognitive processes are grounded in the original sensorimotor states in which the information was experienced and acquired. Rather than information being 'reformatted' into amodal symbols in a separate representational system, information retrieval involves partially reactivating sensory, motor or introspective states in their original modalities (Winkielman et al., 2009). Evidence in support of this theory comes from interference tasks, where decision making is slowed when participants are concurrently performing mental visual imagery and visual perception tasks. Participants in a study by Estes et al., (2008) viewed word pairs with typical locations in vertical space (e.g. cowboy hat). Their subsequent responses on a letter identification task were slower and less accurate if the letter appeared in the same area of visual space as that normally occupied by the typical location of the referent. For example, responses in the upper portion of vertical space were impeded following the word pair ‘cowboy hat’ relative to presentation following the words ‘cowboy boots’, as cowboy hats are associated with higher areas of vertical space. Estes et al., (2008) concluded that by mentally simulating the picture of the referent in its appropriate position in vertical space it interfered with the subject’s ability to perceive the letter that appeared in the same location. Pecher et al., (2010) argued that both the facilitation and inhibition effects found in research around mental simulation offer evidence in support of embodied cognition theory, with the effect being determined in part by timing of stimulus onset. The evidence discussed to date suggests that words or pictures describing concrete real-world objects that have an inherent perceptual position in visual space can – through the process of perceptual simulation – act as ‘cues’ to influence attention. But what about words describing abstract concepts that are not inherently linked to spatial positions, which are instead linked to spatial concepts ‘metaphorically’?

The Case for Metaphor – Figurative Language or Cognitive Tool?

Debate about the fundamental role of metaphor to human endeavour is far from recent and stretches back as far as Aristotle, who described it as “a sign of genius, since a good metaphor implies an intuitive perception of the similarity in dissimilar” (McKeon, 1941. p.1459). In contrast, philosopher, John Locke (1959) viewed metaphor with grave suspicion, referring to it as nothing more than figurative language designed to move passions and mislead judgement. However Locke’s condemnation also highlights metaphor’s power - to influence emotion and judgement. By contrast Lakoff and Johnson (1980), embrace metaphor for the very reason Locke condemned it –

claiming the way we both think and act is based on a conceptual system that is "fundamentally metaphorical in nature" (p.3).

Metaphors come in many shapes and forms. Nominative metaphors make comparison statements to help us understand the characteristics of one category in terms of the characteristics of another, such as, "My dentist is a butcher". Predicative metaphors use verbs in unusual ways, such as, "He hopped in his car and flew home" (Glucksberg & Keysar, 1990). Conceptual metaphors take the drawing of linkages even further, enabling the structuring of whole classes of abstract ideas along the lines of a seemingly dissimilar, but often more concrete concept. For example, 'love' can be conceptualised in terms of a journey as in, "It has been a bumpy road, but now our relationship is trucking along nicely" (Gibbs, 2011) and morality can be conceived in terms of cleanliness and brightness (Schall, Benton, & Harvey, 2008). It is this type of conceptual metaphor with which this thesis is concerned.

For metaphors to work as spatial cues, abstract concepts would need to act as perceptual symbols, just as arrows and words do, activating perceptual content relating to the metaphorical concept (Schubert, 2005). Conceptual metaphor theory (Lakoff & Johnson, 1980, 1999) proposes exactly that. Using embodied cognition theory, Lakoff and Johnson contend that abstract concepts are grounded in our sensorimotor system just as concrete concepts and objects are. They propose that the link from concrete to abstract is facilitated through a mechanism of metaphoric mapping from source to target domain (Gibbs, 2011). For example, consider the abstract concept of power and the metaphors used to describe it; "He has a high status job", "He's at the bottom of the pecking order." According to conceptual metaphor theory, power can be mapped to the vertical dimension in physical space through the metaphor *control is up/lack of control is down* (Giessner & Schubert, 2007; Schubert, 2005). If that is the case, then activation of the abstract concept of power should trigger perceptual symbols associated with perceptual experiences. The type of perceptual experiences to act as triggers might include seeing powerful people as taller than those without power and powerful people in elevated positions such a winner standing on a podium. Schubert (2005) found that when the names of two groups were presented vertically on a computer screen, participants were faster to identify a group as powerful if it was located in the higher position on the screen but faster to identify powerlessness if the group name was presented at the bottom. Consequently, conceptual metaphor theory would contend that ‘thinking’ about power has us concurrently ‘thinking’ in vertical space.

Divinity is another area in which metaphor appears to influence attention in vertical space. In a target detection task, Chasteen, Burdzy and Pratt (2010) presented participants with words that were related to either God or the Devil. Reaction times were faster when words appeared in spatial locations that were congruent with their metaphorical associations (that is: top and right for God and bottom and left for the Devil). This result supported the findings of Meier, Hauser, Robinson, Friesen & Schjeldahl (2007) who found that participants encoded God-related concepts faster when they were presented in high vertical locations. Chasteen et al., (2010) suggested their findings provided strong evidence for the capacity of metaphors to shift spatial attention.

Conceptual metaphor theory is not without its detractors. For example, McClone (2007, 2011) goes to some lengths to unpick the explanatory value of ‘conceptual metaphor’ as a construct. He argues that just because we talk in metaphors, it is not evidence that we think or mentally represent information in metaphor. In McGlone’s view, most evidence for metaphors as cognitive tools relies on circular arguments that assume the meanings attributed to metaphorical statements reflect how they are represented in semantic memory. For example, using the *theory is a building* metaphor, McClone suggests if we mapped the abstract concept of a theory directly onto the concrete concept of a building, theories would not only share the concepts of ‘foundations’ and ‘structure’ with buildings, but sprinkler systems as well. Recognising their role in figurative language, McGlone instead suggests conceptual metaphors are just ‘part of our knowledge’, reflecting our intuitions, not objective evidence (McGlone, 2007).

Metaphor, emotion and attention. Metaphors linking positive and negative emotions with high and low positions in vertical space are woven through the fabric of western language and culture. Expressions such as “On top of the world”, “The pits of despair”, “Things are looking up” and “Down and out”, demonstrate how metaphor may lead us to conceptualise positive and negative emotion in spatial terms. Research suggesting stimulus words might impact spatial responding goes back as far back as Lundholm (1921). Though concerned with aesthetics rather than metaphor, Lundholm aimed to explore the link between affect and motor expression. Participants were presented with a series of differently valenced adjectives and asked to draw lines that best reflected the adjectives. Positive words were found to generate something of an upward shift in directional tendency (58%), while negative words generated quite a strong downward shift (84%). As previously outlined, Meier and Robinson (2004) propose that we ‘map’ the abstract concept of ‘goodness’ onto the concrete concept of verticality. This, they propose, is why their study found that positive words were evaluated faster when presented in the metaphorically congruent top of the screen position while negative words were evaluated faster in the metaphorically congruent down position. More recently, Brookshire et al., (2010) investigated the relationship between positive and negative words and motor responding and found that upward motor-responses were faster when following a positive word and downward responses when following a negative word.

The link between affect and attention in vertical space along metaphoric lines is not just evidenced using linguistic stimuli. A number of studies have found mood state can influence vertical spatial attention. For example, Wapner, Werner and Krus (1957) found that students who had just received an A-grade for a test were more likely to horizontally bisect a luminous square at a higher point than those who had received an F-grade. This, they concluded, suggested an ‘upward bias’ for those feeling positive and a ‘downward’ bias for those feeling not so positive. More recently, Meier and Robinson (2006) suggested that a depressive state (or even trait) can lead people to bias their selective attention downwards. They found that people who scored highly on

Goldberg's neuroticism scale (1999) (which they suggest can be used as an analogue for a negative dispositional state) were faster to spot targets when they appeared in the lower portion of a computer screen than in the upper portion of the screen. Feeling down may, through its metaphorical mappings, lead people to look down (Meier & Robinson, 2006).

Other Theories of Emotion and Attention

Meier and Robinson (2004; 2006) are not alone in suggesting emotion may influence spatial attention, but they are alone in focusing on just the link between emotion and verticality of selective attention. Broader theories of emotion tend to fall into one of two categories – those that focus on valence and those that focus on arousal (Derryberry & Reed, 1998; Fredrickson, 2004; Heller, 1993; Russell, 2003). Heller's (1993) model proposes emotion is made up of both of these dimensions: valence and arousal. Each dimension occupies an orthogonal axis, with valence ranging from pleasant to unpleasant and arousal ranging from high to low. Heller suggests this theoretical model of a two-dimensional conceptualisation of emotion is supported by two distinct neural systems. The frontal lobes are seen as active in relation to the evaluation of valence information while the right parietotemporal region is implicated in the modulation of autonomic arousal (Heller, 1993; Kensinger, 2004).

Valence and attention. A number of models have attempted to represent the relationship between positive and negative valence and the 'shape' of attention. Schwartz and Clore (1983) proposed an affect-as-information model, in which affect 'guides' the style of cognitive processing a person employs. Positive affect leads to a global cognitive style, relying on general knowledge structures and favouring heuristic processing. Negative affect instead leads to a more analytical cognitive style, favouring attention to detail and drawing on external sources of information rather than relying on known scripts.

Fredrickson's (2004) broaden-and-build theory of positive attention suggests that positive emotions such as joy, interest, contentment and love broaden a person's immediate thought-action repertoire, as well as their general mind-set. Fredrickson contrasts this with the effect of negative emotion on attention, cognition and action, which is to narrow attentional scope to enable a select, fight or flight series of responses. In support of the broaden-and-build theory, Fredrickson and Branigan (2005) found that participants in a global-local visual processing choice task showed a broader scope of attention following viewing of positive film clips, than following neutral film clips that elicit no particular emotion. Following positive mood induction, participants were more likely to say a triangle made up of squares matched the stimulus ‘triangle’ (that is, its global shape) than matched a square - the local feature of which the larger shape was made up. However, there was less support for the corollary hypothesis that a narrower scope of attention would follow viewing of negatively valenced film clips. The researchers concluded their mood-inducing stimuli may not have been strong enough to demonstrate an effect. However based on other theories of attention outlined below, I suggest an alternative hypothesis is that positive and negative stimuli interact with attention in different ways or that other dimensions of affect – such as arousal or motivation – are playing a role.

Gasper and Clore (2002) did find evidence in support of the negative corollary of the broaden-and-build theory. When asked to view and reproduce an image, participants experiencing negative affect were more likely to exhibit a bias of attention toward local features, while those in a positive mood were more likely to replicate the broader, global features of the image. However, Gasper and Clore did not include a control group. Consequently, it is unclear whether negative affect ‘narrowed’ attention, or whether the bias of attention toward local features was similar to what would have been displayed by a neutral control group.

Using an eye-tracker to determine both the number of saccades and the relative time fixated on central versus peripheral stimuli, Wadlinger and Isaacowitz (2006) found evidence for the broadening of attention under a positive induced mood, but not for the narrowing effect of negative mood. Participants in an induced positive mood showed increased attention to images appearing in the periphery if the images were of a high positive valence. They also made more frequent saccades to images with low/medium positive valence and neutral valence. These results held even after the experiment was repeated, controlling for arousal level of the images. Wadlinger and Isaacowitz did note an interesting observation, in that when an image was highly positive, the broadening of attention was reflected through longer viewing times to peripheral information, but when information was less highly valenced (though still positive or at least neutral) the broadening of attention took the form of increased saccades around the visual field. Like Fredrickson and Branigan (2005), Wadlinger and Isaacowitz found no difference in attentional scope following presentation of neutral and negatively valenced images, suggesting the relationship affect and spatial attention may be about more than just valence.

Rowe, Hirsch and Anderson (2007) used an Eriksen flanker task to test for a change in visuo-spatial attention following positive or negative mood induction. In this task, participants are asked to focus on a central target and ignore ‘irrelevant’ flanker stimuli. Performance is measured by the degree to which these response-incompatible items interfere with and slow responding to the central target. In keeping with the broaden-and-build theory (Fredrickson, 2004; Rowe et al., 2007) Rowe et al., concluded that positive affect serves to broaden the scope of attention, as those in an induced positive mood were more likely to be distracted by flanker stimuli. However, they found no particular effect of sad mood on attention. Like Fredrickson and Branigan (2005), they ponder whether the stimuli used (melancholic music) was aversive or exclusively negative enough to result in a change in attentional scope. They considered that a stimulus may need to be fear-or anxiety-provoking, not just ‘negative’ to trigger attentional narrowing. The Rowe et al., findings highlight the challenge of ascertaining whether it is valence per se, or another dimension of affect (such as arousal) that is influencing attentional scope. They also highlight that there are other potentially ‘automatic’ effects of valence on attention, apart from metaphor, that may be pulling attention in ways other than the up/down dimension.

Arousal and attention. Easterbrook (1959) was perhaps the earliest theorist to suggest that emotional arousal placed pressure on attentional resources, thereby reducing the focus of attention to those cues that are salient to the emotional experience. His 'cue-utilisation theory' has been incorporated into the concept of a 'weapon focus' in the context of eye-witness testimony, which suggests that in moments of high arousal (such as when faced by an armed attacker), attention can become tightly focused on the cue that is central to the arousing experience (the weapon). This appears to occur at the expense of peripheral details (such as the attacker's clothing) leading to gaps in subsequent ability to report details of the high-arousal event (Kensinger, 2004; Loftus et al., 1987).

In the context of a priming task using emotional pictures, arousal has also been implicated in shifting attention to the left, while valence had no influence on lateral spatial attention (Robinson & Compton, 2006). Following exposure to emotional pictures which varied on both valence and arousal, participants carried out a dot discrimination task. A significant Arousal x Visual Field interaction suggested a role for arousal in modulating perceptual asymmetry. The authors proposed this is a result of lateralization, in which both spatial representation and arousal are more closely linked to the right hemisphere of the brain, leading to a left-side advantage. While this provides support for the role of arousal in directing attention in visual space, it provides yet another model for ways in which visual attention may be affected by emotional stimuli in a priming/CRT task.

As well as there being evidence that arousing stimuli 'focus' attention, there is also evidence that arousing stimuli are prioritised for processing when attentional resources are under pressure. This prioritised attention has been demonstrated using an 'attentional blink' paradigm, in which participants often miss the second target in a rapid visual stream of items. When the second item elicits emotional arousal, however, it is less likely to be missed (Kensinger, 2004). For example, Keil and Ihssen (2004) found that both positively and negatively valenced arousing verbs led to enhanced second target accuracy in contrast to non-arousing verbs. Similar findings in relation to the power of arousing stimuli to capture attention have been found in visual search and spatial cueing tasks (Fernandes et al., 2011), suggesting the effects of arousal on attention are not limited to a single paradigm.

Enduring states of high-arousal also appear to bias attention. Research looking specifically at attentional biases caused by negative attention, has found that participants high in both trait and state anxiety processed local targets faster than their less anxious counterparts (Derryberry & Reed, 1998). However, responses to global level targets were faster than responses to local targets among all participants. This suggests that regardless of emotional state, people take an initial ‘global’ attentional view, but those who are anxious (that is, particularly sensitive to arousing stimuli) are more quickly able to adjust their level of attention and focus on salient stimuli. Derryberry and Reed suggest this approach is adaptive under threat conditions in that it allows a quick scan of the wider environment, followed by a rapid focusing on detail, which may elicit more information about the threat posed by a situation. While Eysenck (1992) proposed that anxiety led to a broad focus of attention, followed by a rapid focusing on a threat stimulus, Derryberry and Reed (1998) suggest that the broad initial focus (what they refer to as a ‘tonic effect’) is followed by a phase in which the ability to rapidly achieve a narrow focus persists. It is not that the attentional window has shrunk, but that while attention remains wide, the zoom-lens can be rapidly focused on any stimulus thought to be relevant to the threat situation.

However, among the challenges to interpreting evidence in this area is that arousal research has predominantly focused on negative arousing experiences not positive arousing experiences (Fernandes et al., 2011). This raises the possibility that the narrowing effect attributed to arousal is in fact a manifestation of the narrowing effect for negative stimuli outlined in theories such as broaden-and-build (Fredrickson, 2004). Furthermore, the relatively ‘weak’ nature of the arousal stimuli (words, pictures, film clips) in comparison to real-life events may have compromised the robustness of the findings (Fredrickson & Branigan, 2007; Rowe et al., 2007).

Neuroimaging evidence. Converging evidence from neuroimaging studies supports the independent nature of valence and arousal as dimensions of emotion (Gianotti et al., 2008; Kensinger, 2004). Stimuli requiring processing on a valence dimension appear to activate the prefrontal cortex, while stimuli requiring processing according on an arousal dimension appear to activate the amygdala (Kensinger, 2004). Furthermore, studies using Event Related Potentials (ERP) following emotional words and pictures indicate different time periods for reaction in relation to valence and arousal. Valence is activated first at around 105ms post-stimulus exposure, followed by arousal at around 180ms, though the last microstate in which valence information is extracted overlaps exactly with the first microstate in which arousal is extracted (Gianotti, 2008). This supports the suggestion from behavioural studies that valence and arousal have the potential to influence attention in independent ways.

Independent, yet interacting? One possible way to reconcile the literature in relation to the roles of valence and arousal on vertical spatial attention is to consider these two dimensions as independent but interacting. This is an approach that seems to have increasing currency (Fernandes et al., 2011; Jefferies et al., 2008; Robinson, Storbeck, Meier, & Kirkeby, 2004). Using both word and picture versions of a choice reaction time task, Robinson et al., (2004) found that negative valence/high arousal stimuli and positive valence/low arousal stimuli were evaluated more quickly than negative/low arousal or positive/high arousal stimuli. This result suggested that evaluative processing is facilitated for words and images that are anxiety provoking or calming, but not for stimuli that are sad or exciting. One possible explanation for this ‘cross over’ effect is that high arousal stimuli are initially assumed to be negative, while low arousal stimuli are assumed to be positive (Citron, Weekes, Festle, in press) Responses are therefore faster when the arousal and valence of a stimulus are congruent, rather than incongruent. This pattern of interaction would be consistent with the neuroimaging research suggesting that valence is assessed first, followed by arousal and then a re-visitation of valence again (Gianotti et al., 2008).

Using an attentional blink paradigm, Jeffries et al., (2008) found the highest level of performance, as measured by second target accuracy, in the negative valence/low arousal (i.e. sad) induced mood condition. In comparison, the lowest level of accuracy was observed in the negative valence/high arousal (i.e. anxious) condition. While providing evidence for the concept that affect influences prioritisation of items for visual attention, it contradicts the findings of Robinson et al., (2004) in which responding was fastest when items were anxiety provoking or calming, not sad. It also runs contrary to work that suggests sadness reduces attentional performance among chronically dysphoric people – perhaps highlighting a difference between moment-to-moment effects of valence and arousal on attention and moderate to severe chronic mood states (Rokke, Arnell, Koch, & Andrews, 2002).

The motivational dimension model of affect. Clore et al., (2001) describe arousal as commanding attention, while valence is linked to approach and avoid motivation. Gable and Harmon-Jones (2010a) disagree that valence is the determinant of approach and avoidance motivation, suggesting instead that goal pursuit is what determines whether a stimulus is intensely motivating or not. Consequently, it is motivation, not valence or arousal alone which they argue determines whether attention is broad or more focused. Citing the importance of approach-motivated positive affective states to human survival they suggest it is ‘status quo’ situations of either positive or negative valence that lead to a broadening of attention, and goal directed ‘approach or avoid’ conditions that lead to a narrowing of attention. Broadening of attention while either fleeing a tiger or approaching a potential reproductive mate would, they suggest, be maladaptive. Both these conditions – which are high in motivational intensity, but on opposite poles in terms of positive and negative valence – would lead to a narrowing of attention. It is Gable and Harmon-Jones’ contention (2010a) that only positively valenced stimuli that are low in approach motivation – such as the kind of stimuli used in most experimental research in this field to date - would lead to a broadening in attention and cognitive processing more generally. Positively valenced stimuli that are high in approach motivation would narrow attention to what was 'really important' in the visual field. Their theory is supported by findings from seven separate studies conducted using Navon letter stimuli (Gable & Harmon-Jones, 2010b). In each of the studies, Gable and Harmon-Jones found support for the narrowing of attention in response to appetitive stimuli (such as pictures of delicious desserts) in comparison to either neutral stimuli (pictures of rocks) or low-approach positive stimuli (cute cats). Furthermore, they found that participants with high trait-approach motivation showed this response even more strongly, suggesting that the influence of motivation works at both a trait and a moment-to-moment state level (2010b). Results in relation to negative affect also support their motivational dimensional model, in that, as predicted, stimuli that induced negative affect with low motivational intensity facilitated a broadening of attention, while negative stimuli that were high in motivational intensity narrowed the focus of attention. These results reflect an expansion of the work by Forster and Higgins (2005) on their 'regulatory-focus theory'. Forster and Higgins used a wider scope for their concept of motivation, referring to 'promotion' and 'prevention'. Using a variation on the Navon letter task, they too found that a promotion focus was linked to global processing, while a prevention focus was associated with local processing.

Current evidence therefore seems to favour a cross-over interaction between valence and arousal, with processing speed being enhanced when valence and arousal are congruous. This crossover effect seems consistent with motivational or goal-oriented theories, with attention being intensified and response times speeded up in relation to motivating or goal-relevant stimuli and broadened and potentially slowed, when the prime or target is low in motivational intensity or goal-relevancy. It is within this complex context that consideration of metaphorically congruent shifts in attention must be considered.

All this . . . and automaticity too

Lakoff and Johnson (1980; 1999) argue that abstract, conceptual metaphors are fully grounded in sensori-motor experiences. Following this argument through would lead to the proposition that it was near-impossible to have an abstract thought without activating the matching source-domain representation (Brookshire et al., 2010). The findings of the original Meier and Robinson (2004) study are consistent with Lakoff and Johnson's original view – that activation of the *good is up*/*bad is down* spatial metaphor was automatic and obligatory. They found an effect for both the 'up' and the 'down' element of the metaphor, and they found it following evaluation of a valenced word both when spatial location was cued (Study 1) and when spatial location was not cued (Study 2). This is in keeping with what Murphy (1996) termed the 'strong' interpretation of metaphorical representation, in which activation of the metaphorical source-target mappings is 'necessary'. Research by Casasanto (2008) using a speeded antonym judgement task, a lexical decision task and a colour judgement task using marbles, all found participants responded more quickly when the tasks were congruent with the area of vertical space that was metaphorically linked to the word's valence. Unlike the original Meier and Robinson task, word meaning and verticality were made less salient by the task at hand, which lends weight to the automaticity of the affect-metaphor association.

The alternative view is that activation of source domain representations is optional – that is, useful, but not necessary. It is what Murphy terms the 'weak' interpretation of metaphorical representation (Casasanto, 2008; Glucksberg & Keysar, 1990; Murphy, 1996). Whether metaphorical representation is activated may therefore depend on context or task demand. Source-domain representations may only be activated strategically (Brookshire et al., 2010). Brookshire suggests that rather than automaticity of source-representation being viewed as a binary concept, it could instead be viewed on a continuum. Rather than ask whether conceptual metaphors are or are not activated automatically, we should instead ask to what extent and under what conditions we automatically access source-domain representations.

Summary of the Research to Date

From this discussion, the complexity of the valence/arousal interplay impacting spatial attention is apparent. There is substantial evidence that symbols can act as ‘cues’ to direct spatial attention (Green, 2012; Ristic & Kingstone, 2009). Words such as ‘up’ and ‘down’ are such ‘overlearned’ cues, that they direct attention automatically (Hommel et al., 2001). There is evidence that words with a metaphorical association to the *good is up*/*bad is down* conceptual metaphor can prime attention in vertical space (Meier & Robinson, 2004). However, whether it is the valence of emotional words, their arousal level or a combination of the two that trigger the activation of the *good is up*/*bad is down* conceptual metaphor and if emotional words automatically trigger attentional shifts in the same way as the words ‘up’ and ‘down’, or the most overlearned of spatial cues, arrows, remains to be resolved.

Given other theories of attention relating to stimulus valence that seem grounded in more evolutionary concepts, such as survival and reproduction, it appears there may be a number of processes at play when we encounter a positive or negative stimulus that broadens or narrows attentional scope rather than shifting it up or down (Gasper, 2002; Fredrickson, 2004; Rowe et al., 2007). In addition, level of arousal is thought to have an independent, yet potentially interacting effect on spatial attention, with low arousal states leading to a broad attentional focus and high arousal states leading to attentional narrowing (Derryberry & Reed, 1998; Easterbrook, 1959; Fernandes et al., 2011; Keil & Ihssen, 2004; Kensinger, 2004). Taking this interactional approach a step further, motivational models of attention suggest valence and arousal combine to influence the goal-orientation of a stimulus, with a narrowing of approach in response to appetitive stimuli and a broadening of approach in relation to stimuli low on motivational intensity.

Meier and Robinson (2004) suggest their study provided evidence for the automatic or obligatory activation of metaphorical associations by positively and negatively valenced words. However, more recent research suggests the automaticity of metaphorical associations only occurs under certain conditions (Brookshire et al., 2010; Casasanto, 2008; Godfrey, 2011), for example when attention is directed toward word meaning rather than perceptual features of a word stimulus (Brookshire et al., 2010).

The Current Study

The purpose of the current study was therefore to progress the discussion about how and when affective stimuli, in the form of emotional words, automatically activate the *good is up*/*bad is down* conceptual metaphor. The first question was whether it is the valence of emotional words, their arousal level or an interaction between the two that trigger the activation of an affect-metaphor association, as observed by Meier and Robinson (2004). The role of valence and arousal in directing spatial attention was assessed by controlling for and manipulating arousal as well as valence. The second question was whether affective stimuli, in the form of emotionally valenced words, automatically activate the associated *good is up*/*bad is down* spatial metaphor or if this only occurs following evaluation of word valence. To assess this, the level of evaluation of the stimulus words was altered to minimise the salience of word-valence prior to responding to a neutral target. This addressed the concern expressed by Brookshire et al., (2010) that Meier and Robinson's (2004) original design did not enable a thorough test of automaticity because it cued both location and valence as salient.

To achieve this, a modified form of Meier and Robinson's (2004) choice reaction time (CRT) task was used, using words from the Affective Norms for English Words database (ANEW; Bradley & Lang, 1999) that are normed on both valence and arousal. This study comprised three experiments. The first served to test the influence of conceptual metaphor theory on spatial attention when word stimuli were controlled on both valence and arousal. The second assessed whether emotional words could prime metaphorically congruent areas of vertical space, without an explicit evaluation of the affective tone of the word taking place. The third experiment assessed whether emotional words could prime metaphorically congruent areas of vertical space under conditions where evaluation is encouraged, but not required, by the task. Together, these experiments aim to grow our understanding of the role of valence and arousal as well as adding to the evidence about whether metaphorical associations are automatic and 'over learned' (Robinson & Compton, 2006), or optional processes that depend on context, which are engaged when the demands of the situation motivate activation (Brookshire et al., 2010; Murphy, 1996).

Method

Design Overview

This study comprised three 2 x 2 x 2 designs experiments, all of which were fully within-subjects. The independent variables were the valence (high, low) and arousal (high, low) of words presented, and their position (up, down) on the computer screen. The dependent variable was reaction time. Experiments were conducted using an E-Prime computer program (v1.1) (Schneider, Eschman, & Zuccolotto, 2002) and a brief free-recall paper and pencil memory test. Reaction time (RT) data was collected by the E-Prime programme. The paper-based memory task was used to encourage participants to focus on the words presented, rather than for the purpose of data gathering. Recall rates were recorded, but not utilized in analysis as they did not assist in answering the research question.

Experiment 1 – Adding Arousal

The purpose of Experiment 1 was to explore whether valence alone, arousal alone, or a combination of valence and arousal activate metaphor-congruent shifts in spatial attention. Research reviewed earlier suggests that arousal can influence spatial attention both independently and in combination with valence. Meier and Robinson (2004) only controlled for word valence. The current experiment therefore enabled the independent or interacting role of these two dimensions of emotion to be explored, helping to clarify what drives affect-metaphor congruent shifts in attention. No hypothesis was made, due to the contradictory findings in earlier research on what combination of valence and arousal facilitated responding in RT tasks, and the lack of previous research looking at the relationship between valence, arousal and metaphor-congruent attention in vertical space.

Method

Participants

Participants were 54 Victoria University of Wellington undergraduate students recruited through the Introduction to Psychology Research Programme (35 female/19 male, *M* age = 19.37 years, *SD* = 3.03, range = 17 – 34 years). All participants had normal or corrected to normal vision and were proficient in English. They received .5 of a course credit for their participation.

Stimuli and Procedure

Two hundred words were chosen from the ANEW word database (Bradley & Lang, 1999). Each word in the database is graded using a 1-9 scale on both valence and arousal, with 1 representing very negative valence or very low arousal, and 9 reflecting very positive valence or very high arousal. Fifty words were selected to fall into each of four categories: high valence-high arousal (HVHA e.g. sex), high valence-low arousal (HVLA e.g. butterfly), low valence-high arousal (LVHA e.g. murderer) and low valence-low arousal (LVLA e.g. grime). A one-way ANOVA revealed the mean of the high valence words (M = 7.25) was significantly different from the mean of low-valence words (M = 2.51), $F(1, 199) = 1467.23$, $p < .001$. The means of the high arousal words (M = 6.67) were also significantly different to the means of the low arousal words (M = 3.81), $F(1,199) = 1669.63$, $p < .001$.

Ethical approval was received from the Victoria University of Wellington School of Psychology Human Ethics Committee in April 2012. Due to the nature of the experiment, it was possible for up to 15 people to be accommodated in the experimental room at one time and to commence the experiment concurrently. Each participant was seated in front of a 17-inch Dell computer monitor and keyboard.

Prior to commencement, participants were asked to self-adjust the computer monitor to position the center of the screen at eye-height. Following brief verbal instructions (see Appendix A1), 10 practice trials of the CRT task began (see Appendix B). All participants were then presented with 200 trials in which individual words, graded for valence (high or low), and arousal level (high or low), appeared either at the top or bottom of the computer screen. Fifty words from each category (HVHA, HVLA, LVHA, LVLA) were used (see Appendix C). Both word-category and position were randomised. Following Meier and Robinson (2004), a central fixation cue (+++) was presented for 300 ms, then reappeared first, 3.8 cm, then 7.6 cm above or below the centre of the screen. This was to guide attention to either the top or bottom of the screen and reduce error variance from random searching. The word itself then appeared for 300 ms, either 10.2 cm above or 10.2 cm below the centre of the screen. Participants were required to evaluate each of 200 words as pleasant (e.g. generous) or unpleasant (e.g. poison) by pressing a corresponding key on the keyboard (‘U’ for unpleasant, ‘P’ for pleasant). There was a one minute pause at the half-way point (100 trials) to reduce fatigue. Reaction times were recorded – as was accuracy of responding. At the conclusion of the computer-based exercise, participants completed a three-minute paper and pencil free-recall memory task of words that appeared in the experiment. The purpose of the recall task was to encourage attention in the primary task. At the end of this (and each subsequent experiment), participants were fully debriefed and thanked for their involvement.

This experiment is consistent with the stimuli and procedures used by Meier and Robinson (2004) apart from three key differences. First, the words in the current experiment were selected from Bradley and Lang’s ANEW database (1999) so that they had been independently normed on both valence and arousal, whereas Meier and Robinson (2004) created their own normed list graded only on valence. Second, 200 words were used in the current experiment to provide sufficient words in each of four cells as opposed to 100 words across two cells in the Meier and Robinson (2004) study. Third, a brief paper and pencil memory test was added to motivate attention to the words in the experiment.

Results and Discussion

Prior to analysis, the data from four participants were removed due to high error rates (error rate greater than 20%). Reaction times below 300 ms and over 1200 ms were also removed as they are likely to reflect lapses in attention. Mean RTs and standard deviations for each condition are shown in Table 1.

Table 1

Experiment 1- Means and Standard Deviations of Reaction Times by Stimulus Type and Position in Milliseconds

	Reaction Times			
	High Arousal		Low Arousal	
	Upper Position	Lower Position	Upper Position	Lower Position
High Valence	736.51 (90.18)	739.61 (87.46)	756.92 (81.79)	780.99 (83.47)
Low Valence	760.19 (92.34)	764.47 (88.18)	790.93 (90.16)	796.69 (93.39)

A 2 (Valence: High, Low) x 2 (Arousal: High, Low) x 2 (Position: Up, Down) repeated measures ANOVA revealed a main effect of Valence, $F(1, 49) = 15.54$, $p <. 001$, with RT to high valenced words being faster ($M = 743$ ms) than to low valenced words ($M = 766$ ms). There was a main effect of Arousal, $F\ (1, 49) = 90.52$, $p < .001$, with high arousal words being identified faster ($M = 739$ ms) than low arousal words ($M = 771$ ms). There was also a main effect of Position, $F\ (1,49) = 9.44$, $p < .001$, with words in the up position being identified faster ($M = 749$ ms) than words in the down position ($M = 761$ ms). The main effects of Valence and Position are best interpreted in the light of a significant Valence x Position interaction, $F\ (1,49) = 4.71$, $p < .05$. Post hoc analysis showed that high valenced words presented in the up position were identified faster than when they were presented in the down position. $t(49) = 3.28$, $p < .05$, but RTs for low valenced words did not differ across position. This interaction is shown in Figure 1.

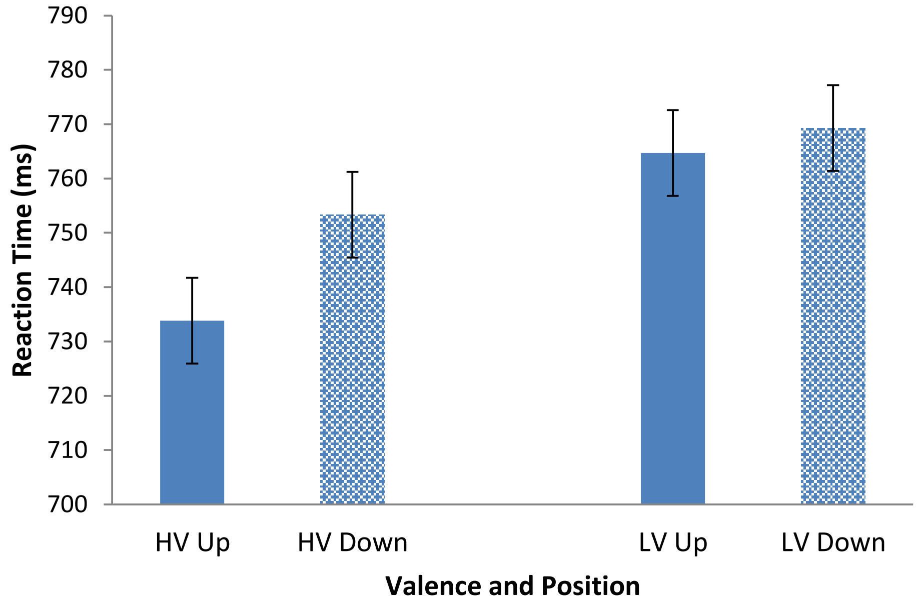

Figure 1. Mean reaction times (ms) by valence and position

These results partially support the findings of Meier and Robinson (2004), in that the mean reaction time to high valenced words was faster when they were located in the metaphorically congruent ‘up’ position. However, the reaction to low valenced words was not faster when they appeared in the ‘down’ position as would be predicted if activation of the *good is up/bad is down* metaphor was highly reliable. Contrary to what might have been expected on the basis of earlier research (e.g. Robinson et al., 2004), there was not a significant Valence x Arousal interaction. It appears that Valence, rather than Arousal or a combination of the two is primarily responsible for the affect-metaphor consistent shift in spatial attention.

Experiment 2 – Removing Active Evaluation

With at least partial replication of Meier and Robinson's (2004) findings, suggesting a role for valence in triggering an affect-metaphor association in response to emotional words, the purpose of Experiment 2 was to establish whether affect-metaphor associations are automatically activated when the affective tone of stimulus words is not evaluated. The design of Experiment 2 also makes vertical position a less salient factor, as the stimulus words appear in a central position on every trial. It is a subsequent neutral target that is randomly assigned to the upper or lower screen position. As the priming word is always presented in the middle of the screen, attention is not directed to the position of the subsequent neutral target. This experiment is, therefore, more likely to expose competing influences from other valence and arousal theories, such as Fredrickson's (2004) broaden and build hypothesis as well as the broadening and narrowing effects of arousal.

Method

Participants

Participants were 52 Victoria University of Wellington undergraduate students recruited through the Introduction to Psychology Research Programme (44 female/8 male, *M* age = 19.35 years, *SD* = 4.91, range = 17 – 46 years). All had normal or corrected to normal vision and were proficient in English. They received .5 of a course credit for their participation. Participants who had taken part in Experiment 1 were not eligible to take part in Experiment 2.

Stimuli and Procedure

The stimuli for Experiment 2 were the same as for Experiment 1, that is, two hundred words selected from the ANEW word database (Bradley & Lang, 1999) graded on both valence and arousal. The computer specifications and seating arrangements were also the same as for Experiment 1. Though the verbal instructions differed slightly (see Appendix A2), the procedures either side of computer task remained unchanged. In Experiment 2, words appeared in the middle of the screen for 300 ms and acted as a prime for a neutral target (letter 'p' or 'q') that appeared randomly at the top or bottom of the screen, 10.2 cm above or below the center. There was no requirement or instruction to evaluate the stimulus word for meaning. Both word-category and position were randomized.

As in Experiment 1, this experiment was consistent with the stimuli and procedures used by Meier and Robinson (2004) apart from the issues mentioned previously. It also differs in that Meier and Robinson asked participants to provide a verbal judgement (saying ’positive’ or ‘negative’ into a microphone) in response to the prime word, and prior to locating the neutral target, whereas this experiment does not require evaluation of the prime words in order to complete the task.

Results and Discussion

Reaction times below 300 ms and over 1200 ms were removed. Mean RTs and standard deviations across conditions are presented in Table 2.

Table 2

Experiment 2- Means and Standard Deviations of Reaction Times by Stimulus Type and Position in Milliseconds

	Reaction Times			
	High Arousal		Low Arousal	
	Upper Position	Lower Position	Upper Position	Lower Position
High Valence	643.49 (103.62)	649.04 (96.62)	642.44 (91.98)	644.38 (101.30)
Low Valence	637.42 (95.39)	653.10 (98.52)	645.34 (100.88)	645.15 (107.61)

A 2 (Valence: High, Low) x 2 (Arousal: High, Low) x 2 (Position: Up, Down) repeated measures ANOVA revealed no significant main effect of Valence, ($F < 1$), Arousal, ($F < 1$) or Position, $F(1,51) = 1.867$, $p = .178$. There were no significant interactions.

The results appear to support the suggestion by Brookshire et al., (2010) that the affect-metaphor association is context-dependent rather than fully automatic or obligatory. The findings did not replicate those of Meier and Robinson’s (2004) in support of conceptual metaphor theory.

Nor did the results provide support to an alternative model of attention, such as Fredrickson's broaden-and-build theory (2004). In Meier and Robinson's (2004) version of this task, participants had to actively evaluate the valence of the word by saying 'pleasant' or 'unpleasant' before the neutral target could appear. This vocalisation of word meaning is likely to provide a strong cue for activation of the affect-metaphor association (Godfrey, 2011). One possibility for the lack of any significant results is that the boundary had been moved too far – from providing a vocalised response to no evaluation at all may have been too large a shift. Consequently a third experiment was designed to test the 'middle ground' in which evaluation of word meaning is encouraged but optional.

Experiment 3 – Incidental Evaluation

Experiment 3 was modelled on the design of Experiment 2, with only one change. In the course of the task instructions, participants were encouraged to evaluate the valence of the stimulus words as they appeared on screen, to assist them to perform a subsequent recall task. This was seen as a less stringent test of automaticity than was administered in Experiment 2.

Method

Participants

Participants were 46 Victoria University of Wellington undergraduate students recruited through the Introduction to Psychology Research Programme (36 female/10 male, *M* age = 19.27 years, *SD* = 3.81, range = 17 – 43 years). All had normal or corrected to normal vision and were proficient in English. They received .5 of a course credit for their participation. Participants who had taken part in Experiment 1 or 2 were not eligible to take part in this experiment.

Stimuli and Procedure

The stimuli and procedures for Experiment 3 were the same as for Experiment 2, with one exception. Participants were advised that they would be completing a paper based memory test at the end of the computer based task. They were shown a sheet of paper with two columns; one labeled ‘pleasant’ and one labeled ‘unpleasant’, on which they would record the remembered items. They were instructed to mentally evaluate each word as pleasant or unpleasant as it appeared on screen, to help them remember words to go in each column (see Appendix A3). All other details including the stimulus words, timing, and position on the screen were the same as for Experiment 2.

Results and Discussion

Reaction times below 300 ms and over 1200 ms were removed. Mean RTs and standard deviations across conditions are presented in Table 3.

Table 3

Experiment 3 - Means and Standard Deviations of Reaction Times by Stimulus Type and Position in Milliseconds

	Reaction Times			
	High Arousal		Low Arousal	
	Upper Position	Lower Position	Upper Position	Lower Position
High Valence	652.69 (104.19)	659.82 (101.55)	658.04 (96.66)	660.20 (94.12)
Low Valence	654.86 (91.97)	654.04 (89.02)	660.71 (102.42)	658.02 (99.33)

A 2 (Valence: High, Low) x 2 (Arousal: High, Low) x 2 (Position: Up, Down) repeated measures ANOVA revealed no significant main effect of Valence, ($F < 1$), Arousal, F (1, 45) = 1.578, $p = .216$ or Position, ($F < 1$). There were no significant interaction effects.

Despite the addition of a low-level evaluation step, reaction times did not differ significantly by Valence, Arousal or Position. Consequently, the results of this experiment did not provide support for conceptual metaphor theory, nor for Meier and Robinson’s (2004) proposition that metaphors are automatically accessed in response to a positive or negatively valenced stimulus. The results did not provide support for Fredrickson’s (2004) broaden and build hypothesis either, and no effect of arousal on attention was found.

It is notable that the mean reaction time across tasks in Experiment 3 (M = 657.30, SD = 96.65) was significantly faster than the mean reaction time in Experiment 1 (M = 769.44, SD = *89.36,)* $t(741)$ = 16.43, p. <.01, suggesting that less time was spent evaluating words in Experiment 3. It is also notable that though the mean reaction time in Experiment 3 (M = 657.30, SD = 96.65*)* was marginally slower than in Experiment 2 (M = 645.04, SD = 98.85) the difference was not statistically significant $t(782\ )$ = -1.75, p.=0.80. This suggests that despite the attempt to encourage evaluation, the level of evaluation carried out in Experiment 3 was not significantly different from the level of evaluation carried out in Experiment 2.

General Discussion

The purpose of this thesis was to progress the discussion about how and when affective stimuli, in the form of emotional words, automatically activate the *good is up*/*bad is down* conceptual metaphor. The first question posed was whether it is the valence of emotional words, their arousal level or a combination of the two that trigger the activation of a metaphor-congruent shift in spatial attention. Partial support for Meier and Robinson's (2004) proposition that it is valence that drives the affect-metaphor association was found in Experiment 1. A significant effect of the *good is up* but not *bad is down* half of the metaphor was revealed, which was best explained by a Valence x Position interaction. While this provides some evidence in support of the role of metaphor in guiding spatial attention, the effect was only found for the *good is up* metaphor, making the affect-metaphor relationship appear more fragile than suggested by Meier and Robinson. The second question posed was whether the association between affect and metaphor is automatically activated on viewing an emotional word, or whether it is only activated when the emotional tone of the word is evaluated. The results of Experiment 2 and Experiment 3 suggest that activation of the *good is up*/*bad is down* spatial metaphor on exposure to a positively or negatively valenced word is not automatic and obligatory. When evaluation of word valence is made voluntary within the task, and the priming word is located in the centre of the screen, there was no evidence for the automatic or obligatory activation of the *good is up/bad is* down conceptual metaphor. It appears that verticality, valence or some combination of the two need to be made salient to the task in order for the *good is up*/*bad is down* metaphor to be activated, once words are controlled and manipulated on the basis of both valence and arousal.

Methodological Explanations

One possible explanation for the failure to replicate the *Bad is down* dimension of the affect-metaphor association in Experiment 1 is that the methodology created a bias toward responses in the upper portion of the screen due to positioning of equipment. This appears unlikely. Computer screens were adjusted to ensure the central point of the screen was in line with eye height. Another possibility is that use of the ‘U’ key for unpleasant responses and ‘P’ key for pleasant responses led to some form of right-hand advantage for ‘P’ responses, as that key was pressed with the right index finger. While this cannot be ruled out, it mirrors the process used by Meier and Robinson (2004) in which ‘U’ key presses with the left-index finger resulted in a significant result, so cannot be the exclusive or even significant contributing factor to the null results.

Yiend (2010) suggests that attentional bias can be produced by emotional stimuli that have particular salience for an individual. Another possible methodological explanation for the partial result in Experiment 1 and the null results in Experiment 2 and 3 is that the addition of the memory test led people to focus more on the personal significance than the emotional valence of the word stimuli than they did in Meier and Robinson’s (2004) version of the task, in an attempt to organise that information for later retrieval. This is speculative, as subsequent interview or analysis was not carried out to establish the personal significance of stimulus words to life events or interests of participants.

A further possibility is that the null result with regard to the automatic activation of affect-metaphor associations in Experiments 2 and 3 was the consequence of changing two variables at once (using a different word list that controlled for arousal as well as valence, and reducing evaluation) rather than just changing one at a time. These adjustments may have made the test of automaticity more stringent. However, because Meier and Robinson (2004) claimed the effect of metaphor was obligatory, manipulating more than one variable and adding a memory test to the end of the experiments should have diluted the effect, as in Experiment 1, and eliminated it, as in Experiments 2 and 3.

The Role of Valence

The main effect of valence found in Experiment 1 (with positively valenced words being evaluated faster than negatively valenced words) is consistent with the Meier and Robinson (2004) study on which the current experiments were based, and the findings of Robinson et al., (2004). Using words and pictures that were rated on both valence and arousal, Robinson et al., found that positive stimuli were evaluated more quickly than negative stimuli. However, both the current findings and the findings of Meier and Robinson, and Robinson et al., seemingly contradict other valence research and theory which suggests negatively valenced stimuli ‘grab’ attention and therefore receive priority for processing and responding (Fernandes et al., 2011).

Schwartz and Clore’s (1983) affect-as-information model suggests affect ‘guides’ the style of cognitive processing a person employs in relation to a given stimulus. Within this model, positive affect leads to a global cognitive style, relying on general knowledge structures and favouring heuristic processing. By contrast, negative affect leads to a more analytical cognitive style, favouring attention to detail and drawing on external sources of information rather than known scripts. Faster responding in relation to positively valenced words could therefore be the result of a quick, heuristic processing style. The slower mean RTs in relation to negatively valenced words would be accounted for by the engagement of a more detailed and analytical cognitive process. However, Lavender and Hommel (2007) suggest emotional words lack ecological significance and consequently bias processing towards higher level cognitive mechanisms and away from automatic processing. This would suggest that all words were likely to be subject to an analytic cognitive process and reduce the likelihood that heuristic methods could be employed in a way that would lead to a statistically different processing speed in favour of positively valenced words. However a large body of literature on the priming effect of words would suggest automaticity of processing, particularly for 'well-learned' or 'over-learned' words and symbols (Hommel, Pratt, Colzato & Godjin, 2001; Lien, Ruthruff, Kouchi, & Lachter, 2010; Neely & Kahan, 2001; Tulving & Schacter, 1990).

Another possible explanation is that positively valenced words trigger an approach motivation and hence faster responding. Chen and Bargh (1999) found positively valenced words primed an approach response while negative words primed avoidance. This was simulated using a lever which could be pulled towards the participant (likened to an approach) or pushed away (likened to avoidance). Faster responding on positive words in Experiment 1 could therefore be attributed to activation of an approach motivation. Participants may have been 'drawn in' by positively valenced words, leading to faster responding. In keeping with a 'motivational' model, Lavender and Hommel (2007) suggest that the consideration of goals and intentions is critical when looking at the connection between affect and action. That said, 'avoidance' in this task could most effectively be achieved by a rapid response, as it removed the stimulus word. Using approach/avoidance theory, an equally strong argument could be made for rapid responses to negatively valenced words as the most effective way to 'rid' the participant of the potentially aversive stimulus. Without using a paradigm such as the lever method employed by Chen and Bargh, it is not possible to conclude whether faster responding to positive words was a consequence of an approach-type response.

Rapid responding to positively valenced stimuli also seems to contradict Fredrickson's broaden and build theory (2004) as well as the findings of Fredrickson and Branigan's (2005) affect- induction task which suggested positive emotions broaden the scope of attention in a global-local task. In this broadened, exploratory mode, evaluation and response times are slowed rather than speeded up, in comparison to evaluation in a 'narrow' mode of evaluation which these researchers associate with negative affect or stimuli. However, very recent research using a mood induction technique, the Eriksen flanker task (Eriksen & Eriksen, 1974) and the Attention Network Task (ANT; Fan, McCandliss, Commer, Raz & Posner, 2002) failed to find an attentional broadening effect from positive valence (Bruynell et al., 2012). In light of these findings, Bruyneel et al., propose that there are further processes mediating the relationship between positive affect and attention that are not yet understood. This is a view also shared by Fernandes et al., (2011) who suggest research to date on the influence of both positive affect and positively valenced stimuli on attention, is far from conclusive. The current studies would seem to support this assertion. While a main effect of valence was found when active evaluation was required, it was not found when evaluation was not required. The theoretical options to explain such an effect are many, and contradictory. What it does suggest is that emotion is a multi-faceted phenomenon and that despite the presence of a main effect of valence in the first experiment, considering it in isolation from arousal and approach/avoidance is too simplistic.

The Role of Arousal

Kensinger (2004) proposed that while items that are highly arousing benefit from 'prioritised attention', positively and negatively valenced stimuli that are non-arousing do not. The findings from Experiment 1 lend support to this hypothesis. When emotional words were evaluated and their meanings 'extracted', reaction times were faster when the word was highly arousing than when it was low in arousal. This result occurred regardless of whether the word was positively or negatively valenced. That highly arousing stimuli receive priority attention makes intuitive sense when one considers the purpose of arousal – to trigger the approach or avoid/ fight or flight mechanism (Citron et al, in press; Fernandes et al, 2011; Sakaki, Niki & Mather, 2011). Whether the stimulus that has activated our arousal system signals danger (such as the word 'murderer' from the current study) or the possibility of success or reproduction (such as the words 'millionaire' or ‘sex’), assessing the stimulus with priority attention is likely to increase our chances of survival – by avoiding death or obtaining the possibility of success or reproduction. The finding of a main effect of arousal in Experiment 1 was consistent with the findings of Keil and Ihssen, (2004) in relation to highly arousing positive and negative verbs and sexual and taboo words (Anderson, 2005), as well as studies using non-word stimuli (Fernandes et al., 2011).

However, the lack of a main effect of arousal in Experiment 2 and 3 requires some explanation. One possibility is that, as for valence, the lack of a thorough evaluation meant the word meanings (and their arousing or non-arousing nature) were not sufficiently salient to activate the arousal system. This seems unlikely, as a range of cuing tasks as well as neuroimaging studies have found a fast and automatic appraisal of stimulus arousal (e.g. see Kensinger, 2004; Robinson & Compton, 2006). A possible methodological complexity is that words vary much more in valence level than they do in arousal. Even when words are categorised as relatively ‘high’ or ‘low’ in arousal, we are testing within a relatively narrow band. The degree to which they will trigger fight or flight responses is significantly less than a real-world arousing experience (Bradley & Lang, 1999 and Robinson & Compton). However, there was a highly significant effect of arousal in Experiment 1 which suggests the arousal level indicated by the words was sufficient to influence responding, at least if word meaning is evaluated.

The Effect of Position

The significant main effect of position was not predicted as it was not seen as central to the areas under investigation, so I will comment on it only briefly. Other studies exploring the relationship between emotion and vertical attention have also found statistical differences between high and low responses, favouring responses in the upper area of attentional space. For example, in their ‘sky decision’ and ‘ocean decision’ tasks Pecher et al., (2010) found responses were faster to words presented at the top of the screen. The researchers queried whether it was due to a task-induced spatial attention bias, or a more general advantage for stimuli presented at the top of the screen. It is difficult to see how in the current study, the task itself could have caused an upper visual field advantage. In the Pecher et al., study, though the target words could appear either at the top or the bottom of the screen, only items relating to the upper area of visual space (e.g. helicopter) were presented in the sky task and only items relating to the lower area of visual space (e.g. shark) were presented in the ocean task. In the current study, items congruent with both the *good is up* and *bad is down* dimensions of the spatial metaphor were presented within the same task, meaning that a 'correct' answer could occur in either the top or bottom portion of the screen, therefore reducing the possibility of a task-induced spatial attentional bias. Consequently, it would seem unlikely that the effect of position was due to an upper screen advantage created by the task itself.

Another possible explanation is that responses at the top of the screen were 'favoured' because of the way we visually 'scan' a computer screen. Research from intuitive use studies in the information technology arena suggests that, when interacting with a computer, we apply previous sub-conscious knowledge to enable us to interact as quickly and efficiently as possible (Hurtienne & Blessing, 2007). Users intuitively 'sweep' from top to bottom of a screen, which may mean words appearing at the top of the screen were favoured in terms of response time (Jones, 2012; Microsoft.com, 2012). However, in Experiment 1 – the task in which an effect of position was found – the location of the target words was indicated by the progression of a fixation cue (++++). This should have eliminated the visual 'sweep' process. If this 'sweep' effect had been leading to an advantage for targets in the upper screen position in Experiment 1, then this would likely have led to a main effect of position in Experiment 2 and 3 in which the position of the neutral target, following the valenced word, was not cued. As there was no significant effect of position in Experiment 2 and 3, this does not appear to offer a likely explanation.

Support for Conceptual Metaphor Theory

The finding of a Valence x Position interaction consistent with the *good is up* metaphor lends support to the idea that metaphor-congruent responding is driven by valence and that conceptual metaphors and their source-domain representations are automatically accessed in some, but not all, contexts. This is in keeping with Murphy's (1996) 'weak' interpretation as well as the Brookshire et al., (2010), view that automaticity occurs on a continuum and is context dependent. It appears that while emotional words may cue attention in vertical space by activating the *good is up* metaphor, their symbolic control of attention is not as great as words that explicitly signal an area in vertical space. Unlike the word 'up' (Hommel et al., 2001), the current study suggests words such as 'happy', 'triumphant', 'sex' or 'miracle' require evaluation before their spatial association is activated. This could explain the difference in results between Experiment 1 (in which the response required an active evaluation of the prime word) and both Experiment 2 and Experiment 3. In Experiment 2, participants were not actively asked to evaluate the positive or negative valence of the stimulus word. In Experiment 3, though they were asked to actively evaluate word valence, and were incentivised to do so (as they were told it would assist with the subsequent memory task), there was no requirement to do so in order to complete the task. An analysis of mean RTs in Experiment 1 (in which evaluation was necessary for the task), Experiment 2 (in which evaluation was not sought) and Experiment 3 (in which it was sought, but not required) suggests that in the second two studies participants did not take a significant amount of time to evaluate the stimulus word before responding. In contrast, Meier and Robinson (2004) required participants to actually say the words 'positive' or 'negative' in response to the priming word, prior to searching for the neutral target. Verbalising their valence judgements may in fact have exaggerated the activation of the associated conceptual metaphor – so not just the priming word, but the act of verbalising its positive or negative character – may have moved the task along the continuum toward a point where it was even more likely to trigger the associated spatial representation (Godfrey, 2011). This may explain a lack of both main and interaction effects in Experiments 2 and 3. Without evaluating a word to assess its valence, and verbalising one's view on its positivity or negativity, the current results suggest a word may not activate its associated spatial metaphor.

Good is up . . . but bad is not down. It is also necessary to explain why Experiment 1 provided support for only the 'top half' of conceptual metaphor theory. The failure to find a matching result for low valenced words and the 'down' position also requires consideration. Though Meier and Robinson (2004) found an effect for both positively and negatively valenced words, other studies exploring the relationship between emotion and spatial attention using an array of different paradigms have also found an effect in the positive (i.e. high) valenced but not the negative (i.e. low) valenced condition (e.g. Fredrickson and Branigan, 2005; Wadlinger and Isaacowitz, 2006) . Each of these researchers considered the possibility that the negative stimuli (which varied from film clips, to induced moods, to an Eriksen flanker task) were not sufficiently strong to elicit an effect. The same could be considered in relation to the current study, however the negatively valenced stimuli used in the current studies were selected from a normed database and statistical analysis suggested good differentiation between the groups – the low valenced words should have elicited a 'bad' association just as much as the high valenced words elicited a 'good' one.

Another possibility is that the *good is up* dimension of this binary metaphor is stronger than its *bad is down* counter-part. Chandler (2000) argues that in a binary linguistic pair such as 'good and bad', 'up and down', one term is dominant. This is usually marked by the order in which the pair is conventionally used. In this case, it would give dominance to the 'good' and 'up' terms encompassed by the *good is up*/*bad is down* spatial metaphor because they are usually the first word said in their respective word pairs. There is some empirical support for a difference in cognitive processing speed between priority and non-priority terms in a binary pair. Clark and Clark (1977, cited in Brookshire et al., 2010) suggest that it takes longer to recognise and process the non-dominant form of a word pair and that more recognition errors are made with the non-dominant form.

The most attractive, but speculative possibility is that controlling the arousal level of the words interfered with the full activation of the *good is up*/*bad is down* conceptual metaphor. The main effect of arousal in Experiment 1 was very strong. If valence and arousal are viewed as independent but interacting components of emotion that are linked to activation of different brain regions (amygdala for arousal, prefrontal cortex for valence) (Kensinger, 2004) and different styles of cognitive processing (highly focused for arousal, more elaborative for valence) (Schwartz and Clore, 1983) it maybe that high arousal words were creating a 'short-cut' in the processing of the word stimulus, to a degree 'side-lining' use of the spatial representation associated with the *good is up*/*bad is down* conceptual metaphor when arousal as well as valence is manipulated. This could explain why there was a Valence x Position interaction for positive words and the upper area of visual space, but not negative words and the lower portion of visual space. While these ideas are purely speculative, it does seem, as Fernandes et al., (2011) and Bruyneel et al., (2012) conclude, we are yet to fully understand the nature of the interaction between valence and arousal in spatial attention.

A further possibility is that negatively valenced words tap into a greater range of source metaphors than positive words, thereby activating affect-metaphor relations other than those on the up-down dimension. For example, 'sadness' appears closely associated with the *good is up*/*bad is down* conceptual metaphor (e.g. "I feel down in the dumps", "I can't hold my head up high", "It is a down day"). However other negatively valenced words which connect to emotions such as anger, fear and disgust may tap into alternative, primary source metaphors. For example, anger, more readily relates to source metaphor *anger is heat* (e.g. "I feel hot under the collar", "I was boiling with rage", "It was an incendiary remark") than *bad is down* (Yu, 1995). There is also evidence that there are more versions of the *good is up* metaphor than there are of the *bad is down*. For example, looking at the specific emotions of happy and sad, some metaphors have only a positive dimension. While there are metaphors associated with the positively valenced concepts, *happiness* *is being off the ground* and *happiness is being in heaven*, there is not a negatively valenced equivalent metaphor for sadness (Godfrey, 2011; Kövecses, 2000). It is therefore possible that positive emotions (e.g. happiness, joy, serenity and success) are more automatically captured by the *good is up* metaphor, than negative emotions are automatically captured by the *bad is down* metaphor. This may have contributed to the lack of a significant result for both halves of this conceptual metaphor.

Implications for Automaticity and Conceptual Metaphor Theory

The findings from the current studies add to the work by Brookshire, Irvy and Casasanto (2010), and the work of Godfrey (2011) suggesting that automaticity of affect-metaphor associations occurs on a continuum, with context playing a strong role in determining whether those associations are activated. Controlling for arousal and manipulating the level of evaluation of word valence appear to reduce the automatic activation of the *good is up/bad is* down conceptual metaphor. Some 'salience' of valence (for example through evaluation) or verticality (such as cues signalling word position) appear necessary for the automatic activation of the *good is up/bad is* down affect-metaphor association. Context, it seems, does matter.

The current study lends support to what Murphy (1996) termed the 'weak' view of conceptual metaphor theory, in which metaphoric mappings assist us to represent abstract ideas, but do not monopolise the representation system. It appears that since their 'strong' stance was stated in 2004 and 2005, Meier and colleagues are also entertaining the possibility of more than one source of representation for each target concept. A more recent article by Landau, Meier and Keefer (2010) suggests that in addition to conceptual metaphor theory drawing on embodied cognition, another theory, the 'alternate source strategy', may also apply. This theory acknowledges that target concepts can be structured in terms of more than one source concept (e.g. *good is up* and *good is lightness*), which therefore opens the possibility that abstract concepts may be mentally represented in more than one way. If they can be represented in more than one way, activation of any given target-source association is necessarily context dependent. Such an approach, which softens the exclusivity of the target-source relationship, does help overcome some of the challenges to conceptual metaphor theory set out by theorists such as McClone (2007) and Gibbs (1994, 2011).

Areas for Further Research

In light of the current findings, a number of options for further research emerge. First, given the fragility of the findings in the current study in terms of only partially replicating Meier and Robinson's (2004) Valence x Position interaction, it would be prudent be to take one step back and replicate Meier and Robinson's study exactly. A robust replication of the findings in relation to the original proposition would provide a sound base from which to tinker with the boundary conditions in which an automatic effect can be observed. This would involve using the same word list that Meier and Robinson used, that was not controlled in terms of the arousal level of stimulus words. It is also important to replicate the conditions of Meier and Robinson's Study 2, in which stimulus words were presented centrally, and an oral evaluation process is conducted before a decision is made in relation to the neutral target. If findings from these studies replicated the findings of Meier and Robinson, it would then be possible to control for and manipulate the arousal level as well as the valence level of words used in Study 1 and 2, without making any changes to the level of evaluation of word meaning. Next, by reverting to the original Meier and Robinson (2004) word list, just the level of evaluation could be manipulated. This would allow for a more fine-grained test of the boundary conditions for the automatic activation of the affect-metaphor association.

Recent research by Sakaki, Niki and Mather (2012) suggests that the automaticity of an attentional response to emotional stimuli depends on whether they are biologically or socially relevant. In an fMRI study using emotional images, Sakaki et al., found that emotional pictures linked to survival or reproduction were evaluated automatically, while pictures linked to socially relevant stimuli appeared subject to more elaborative processing. It is possible that Meier and

Robinson's (2004) word list had a higher proportion of biologically relevant stimulus words than the current study, leading to a lower threshold for automatic activation of affect-metaphor linkages. Comparison of the word lists does not make it immediately apparent if there is a biological bias to the Meier and Robinson list in comparison to the words used in the current study. To further understand the boundary conditions for the obligatory activation of metaphor it would be useful to conduct the experiments employed in this study, but using biologically significant emotional words in one condition and emotionally significant emotional words in another. This would remove one possible confound for the results from the current study.

Another consideration for future research is the impact of participants' current mood on decision making (Yiend, 2010). A number of studies exploring affect-attention associations have used mood induction strategies (e.g. Derryberry & Reed, 1998; Rowe et al., 2007; Schmitz, De Rosa, & Anderson, 2009) or have measured depressive symptoms prior to task completion. Each of these studies has suggested a relationship between mood state and spatial attention. One possible explanation for the lack of full replication of Meier and Robinson's (2004) findings, apart from the experimental manipulations conducted, is that participants' current mood state was impacting moment-to-moment responding. The word stimuli may not have been strong enough to alter current mood states if participants came into the experiment feeling particularly happy or sad. This could have especially impacted the experiments in which word valence did not need to be evaluated. Assessing participant mood prior to commencement of the experiment would therefore be a useful step in future research in this area.

Particularly in Experiments 2 and 3, the current study did move the boundary conditions for triggering automatic activation of metaphoric representation quite considerably along the proposed 'continuum' of automaticity. To reduce the stringency of the test, it may be useful to add a vertical 'mood gauge' at the commencement of each experiment. While providing a rough guide as to participant's current mood, as suggested above, it may also work in a suggestive fashion to make the metaphoric valence-verticality link more salient and influence responding. Tan (2011) suggests 'task relevance' greatly influences the focus of attention. It may be that by 'priming' the affect-metaphor association just prior to the experimental task, evaluation of word meaning is not required to trigger automatic activation of metaphoric representations during the task itself.

One final consideration for future research is whether a measurement other than reaction times is required to assess whether source-target associations are being activated at the very earliest stages of processing. As the research to date shows, once the dimensions of both valence and arousal are incorporated into an experimental paradigm, there is variation in which combination of valence and arousal is the 'optimum' for rapid responding (Fernandes et al., 2011; Jefferies et al., 2008; Robinson, Storbeck, Meier, & Kirkeby, 2004). Once there are three factors (valence, arousal and metaphor) involved that could each be operating to push and pull attention across lateral and vertical dimensions, reaction time may no longer be the most appropriate measure of responding. Wadlinger and Isaacowitz (2006) used an eye tracker to explore the pattern of responding in relation to positive and negatively valenced pictures and found attention was more evident in peripheral areas in response to positively valenced stimuli – in keeping with Fredrickson's broaden and build theory (2004). Use of an eye tracker during performance of the current experimental tasks would help determine the pattern of eye movement in response to the emotional words used in this paradigm. It would then be possible to establish whether activation of the *good is up*/*bad is down* metaphor triggers vertical saccades alongside other effects of valence, such as a broadening and narrowing of attention described above, and arousal, which is thought to both heighten attentional focus and shift attention toward the left (Robinson & Compton, 2006). By establishing the relative timing of vertical shifts, lateral shifts and general broadening and narrowing of attention, using this technology may help unpick the automaticity of affect-metaphor activation in relation to emotional stimuli that vary across more than one dimension.

Summary and Conclusions

The purpose of the current study was to progress the discussion about how and when affective stimuli in the form of positively and negatively valenced words automatically activate the g*ood is up*/*bad is down* conceptual metaphor. A series of three CRT tasks was used in which stimulus words were controlled for arousal as well as valence, and evaluation of word valence was manipulated. Evidence for automatic activation of the *good is up* but not *bad is down* conceptual metaphor, driven by valence, was found following evaluation of stimulus words that were controlled for both arousal and valence. This partially replicated the findings of Meier and Robinson (2004) who found evidence for a metaphor-congruent shift in attention consistent with both the *good is up* and *bad is down* elements of the conceptual metaphor. In the second experiment, in addition to controlling for both arousal and valence, the requirement to evaluate the emotional valence of the words was removed to lower the salience of valence and verticality as cues to task performance. In the third experiment, words were also controlled for both arousal and valence, and evaluation of the emotional valence of words was incentivised, but not required for task performance. No evidence for the automatic activation of affect-metaphor associations was found under the conditions where salience of valence and verticality was reduced and there was no, or limited, evaluation of word meaning.

The findings of this study therefore support the work of Murphy (1996) which proposed a ‘weak’ version of source-target representation, in which concrete source domains (in this case the concept of verticality) contribute to, but are not the exclusive way to represent, the abstract target domain (in this case, valence). It builds on the work by Brookshire, Irvy and Casasanto (2010), who found the *good is up*/*bad is down* metaphor was only activated in response to target words, when attention was not directed towards the perceptual features of a task. It also builds on the work of Godfrey (2011) who found no effect for affect-metaphor representation following evaluation of spoken emotional words, suggesting variability in activation between written and aural contexts.

Together, these experiments suggest that unlike symbols such as directional arrows or ‘over-learned’ stimuli such as the words ‘up’ and ‘down’ (Robinson & Compton, 2006), positively and negatively valenced words can operate as symbolic cues for attention in vertical space, but whether they do so depends on context and whether the demands of the situation motivate activation of the associated conceptual metaphor (Brookshire et al., 2010; Murphy, 1996). Specifically, the current study suggests that while word valence can activate affect-metaphor associations, reducing the evaluation of the affective tone of the word reduces automatic activation of metaphor-congruent shifts in spatial attention. While conceptual metaphors certainly assist us to mentally represent abstract emotional concepts, whether they do so automatically depends on the salience of the metaphorical cues and the context provided by the task at hand. Automaticity appears to be a continuum, not an absolute, and metaphors appear to enrich, not monopolise representation of abstract, affective concepts.

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References

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences, 22*(04), 577-660. doi: 10.1017/S0140525X99002149

Berger, A., Henik, A., & Rafal, R. (2005). Competition between endogenous and exogenous orienting of visual attention. *Journal of Experimental Psychology: General*, *134*(2), 207-221. doi: 10.1037/0096-3445.134.2.207

Bradley, M. M., & Lang, P. J. (1999). *Affective norms for English words (ANEW).* Gainsville, FL: The NIMH Centre for the Study of Emotion and Attention, University of Florida.

Brookshire, G., Ivry, R., & Casasanto, D. (2010). Modulation of motor-meaning congruity effects for valenced words. In S. Ohlsson & R. Catrambone (Eds.), *Proceedings of the 32nd Annual Conference of the Cognitive Science Society*. Austin:TX, Cognitive Science Society.

Brunyé, T. T., Mahoney, C. R., Augustyn, J. S., & Taylor, H. A. (2009). Emotional state and local versus global spatial memory. *Acta Psychologica*, *130*(2), 138-146. doi: 10.1016/j.actpsy.2008.11.002

Bruyneel, L., van Steenbergen, H., Hommel, B., Band, G. H., De Raedt, R., & Koster, E. H. (2012). Happy but still focused: Failures to find evidence for a mood-induced widening of visual attention. *Psychological Research, 76*(3), 1-14. doi: 10.1007/s00426-012-0432-1

Casasanto, D., & Boroditsky, L. (2008). Time in the mind: Using space to think about time. *Cognition, 106*(2), 579-593. doi: 10.1016/j.cognition.2007.03.004

Chandler, D. (2000). *Semiotics for beginners*. Wales: University of Wales. Retrieved from http://www.aber.ac.uk/media/Documents/S4B/sem07.html

Chasteen, A. L., Burdzy, D. C., & Pratt, J. (2010). Thinking of God moves attention. *Neuropsychologia, 48*(2), 627-630. doi: 10.1016/j.neuropsychologia.2009.09.029

Chen, M., & Bargh, J. A. (1999). Consequences of automatic evaluation: Immediate behavioral predispositions to approach or avoid the stimulus. *Personality and Social Psychology Bulletin, 25*(2), 215-224. doi: 10.1177/0146167299025002007

Clore, G. L., Wyer, R. S., Dienes, B., Gasper, K., Gohm, C., & Isbell, L. (2001). Affective feelings as feedback: Some cognitive consequences. In L. L. Martin & G. L. Clore (Eds.), *Theories of mood and cognition: A user's guidebook* (pp. 27-62). Mahwah, NJ: Erlbaum.

Coslett, H. B. (1999). Spatial influences on motor and language function. *Neuropsychologia, 37*(6), 695-706. doi: 10.1016/s0028-3932(98)00116-x

Derryberry, D., & Reed, M. A. (1998). Anxiety and attentional focusing: trait, state and hemispheric influences. *Personality and Individual Differences, 25*(4), 745-761. doi: 10.1016/S0191-8869(98)00117-2

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review, 66*(3), 183-201. doi: 10.1037/h0047707

Eriksen, C., & St. James, J. (1986). Visual attention within and around the field of focal attention: A zoom lens model. *Attention, Perception, & Psychophysics, 40*(4), 225-240. doi: 10.3758/bf03211502

Estes, Z., Verges, M., & Barsalou, L. W. (2008). Head up, foot down. *Psychological Science, 19*(2), 93-97. doi: 10.1111/j.1467-9280.2008.02051.x

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & Emotion, 6*(6), 409-434. doi: 10.1080/02699939208409696

Fernandes, M. A., Koji, S., Dixon, M. J., & Aquino, J. M. (2011). Changing the focus of attention: The interacting effect of valence and arousal. *Visual Cognition, 19*(9), 1191-1211. doi: 10.1080/13506285.2011.618151

Fischer, M. H., & Zwaan, R. A. (2008). Embodied language: A review of the role of the motor system in language comprehension. *The Quarterly Journal of Experimental Psychology, 61*(6), 825-850. doi: 10.1080/17470210701623605

Förster, J., & Higgins, E. T. (2005). How global versus local perception fits regulatory focus. *Psychological Science*, *16*(8), 631-636. doi: 10.1111/j.1467-9280.2005.01586.x

Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Phil. Trans. R. Soc. Lond. B, 359*, 1367-1377. doi: 10.1098/rstb.2004.1512

Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition & Emotion, 19*(3), 313-332. doi: 10.1080/02699930441000238

Gable, P., & Harmon-Jones, E. (2010). The motivational dimensional model of affect: Implications for breadth of attention, memory, and cognitive categorisation. *Cognition & Emotion, 24*(2), 322-337. doi: 10.1080/02699930903378305

Gable, P. A., & Harmon-Jones, E. (2010). The effect of low versus high approach-motivated positive affect on memory for peripherally versus centrally presented information. *Emotion, 10*(4), 599-603. doi: 10.1037/a0018426

Gasper, K., & Clore, G. L. (2002). Attending to the big picture: Mood and global versus local processing of visual information. *Psychological Science, 13*(1), 34-40. doi: 10.1111/1467-9280.00406

Gianotti, L., Faber, P., Schuler, M., Pascual-Marqui, R., Kochi, K., & Lehmann, D. (2008). First valence, then arousal: The temporal dynamics of brain electric activity evoked by emotional stimuli. *Brain Topography, 20*(3), 143-156. doi: 10.1007/s10548-007-0041-2

Gibbs, R. W. (1994). *The poetics of mind: Figurative thought, language and understanding*. Cambridge, England: Cambridge University Press.

Gibbs, R. W. (2011). Evaluating Conceptual Metaphor Theory. *Discourse Processes, 48*(8), 529-562. doi: 10.1080/0163853x.2011.606103

Giessner, S. R., & Schubert, T. W. (2007). High in the hierarchy: How vertical location and judgments of leaders' power are interrelated. *Organizational Behavior and Human Decision Processes, 104*(1), 30-44. doi: 10.1016/j.obhdp.2006.10.001

Glucksberg, S., & Keysar, B. (1990). Understanding metaphorical comparisons: Beyond similarity. *Psychological Review, 97*(1), 3-18. doi: 10.1037/0033-295x.97.1.3

Godfrey, H. K. (2011). *Conceptual metaphors of emotion in spoken language: Good is up in semantics and prosody* (Masters' thesis, Victoria University of Wellington, New Zealand) Retrieved from http://researcharchive.vuw.ac.nz.helicon.vuw.ac.nz/bitstream/handle/10063/1857/thesis.pdf?sequence=1

Green, J. J., & Woldorff, M. G. (2012). Arrow-elicited cueing effects at short intervals: Rapid attentional orienting or cue-target stimulus conflict? *Cognition, 122*(1), 96-101. doi: 10.1016/j.cognition.2011.08.018

Hanne, M. (1999). Getting to know the neighbours: when plot meets knot. *Canadian Review of Comparative Literature, 26*(1), 36-50. URL: http://ejournals.library.ualberta.ca/index.php/crcl/article/view/3647/2925

Heller, W. (1993). Neuropsychological mechanisms of individual differences in emotion, personality, and arousal. *Neuropsychology, 7*(4), 476-489. doi: 10.1037/0894-4105.7.4.476

Henderickx, D., Maetens, K., & Soetens, E. (2010). Feature integration and spatial attention: common processes for endogenous and exogenous orienting. *Psychological Research, 74*(3), 239-254. doi: 10.1007/s00426-009-0251-1

Hommel, B. J. (2001). Symbolic control of visual attention. *Psychological Science, 12*(5), 360. doi:10.1111/1467-9280.00367

Hurtienne, J., & Blessing, L. (2007, August). *Design for intuitive use-testing image schema theory for user interface design.* Paper presented at the proceedings of the 16th International Conference on Engineering Design, Paris: Ecole Centrale. Retrieved 8 November 2012 from http://joernhurtienne.com/Publications_files/ Paper_386 _HurtienneBlessing.pdf

Jefferies, L., Smilek, D., Eich, E., & Enns, J. T. (2008). Emotional valence and arousal interact in the control of attention. *Psychological Science, 19*(3). doi: 10.1111/j.1467-9280.2008.02082.x

Johnston, J. C., McCann, R. S., & Remington, R.W. (1995). Chronometric evidence for two types of attention. *Psychological Science, 6*(6), 365-369. doi:10.1111/j.1467-9280.1995.tb00527.x

Jones, B. (2012). Understanding the F-design layout in web design Retrieved 8 November 2012, from http://webdesign.tutsplus.com/articles/design-theory/understanding-the-f-layout-in-web-design/

Keil, A., & Ihssen, N. (2004). Identification facilitation for emotionally arousing verbs during the attentional blink. *Emotion, 4*(1), 23-35. doi: 10.1037/1528-3542.4.1.23

Kensinger, E. A. (2004). Remembering emotional experiences: The contribution of valence and arousal. *Reviews in the Neurosciences, 15*(4), 241-252. doi: 10.1515/REVNEURO.2004.15.4.241

Kövecses, Z. (2000). *Metaphor and Emotion: language, Culture and Body in Human Feeling*. New York: Cambridge University Press. Retrieved on 12 November from http://www.dur.ac.uk/resources/mlac/research/metaphors_as_models/Koevecses2.pdf

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: The University of Chicago Press.

Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenges to Western thought*. New York: Basic Books.

Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin, 136*(6), 1045-1067. doi:10.1037/a0020970

Lavender, T., & Hommel, B. (2007). Affect and action: Towards an event-coding account. *Cognition & Emotion, 21*(6), 1270-1296. doi: 10.1080/02699930701438152

Lien, M., Ruthruff, E., Kouchi, S., Lachter, J., & (2010). Even frequent and expected words are not identified without spatial attention. . *Attention, Perception and Psychophysics, 72*(4), 973-988. doi:10.3758/APP.72.4.973

Locke, J. (1959). An essay concerning human understanding. In A. C. Fraser (Ed.), *Complete and unabridged works*. Oxford: Clarendon Press 1894. Reprinted New York: Dover Inc.

Loftus, E. F., Loftus, G. R., & Messo, J. (1987). Some facts about "weapon focus.". *Law and Human Behavior, 11*(1), 55-62. doi: 10.1007/bf01044839

Lundholm, H. (1921). The Affective tone of lines: Experimental researches. *Psychological Review, 28*(1), 43-60. doi: 10.1037/h0072647

McGlone, M. S. (2007). What is the explanatory value of a conceptual metaphor?. *Language & Communication*, *27*(2), 109-126. doi: 10.1016/j.langcom.2006.02.016

McGlone, M. S. (2011). Hyperbole, homunculi, and hindsight bias: An alternative evaluation of conceptual metaphor theory. *Discourse Processes, 48*(8), 563-574. doi: 10.1080/0163853x.2011.606104

McKeon, R. (Ed.). (1941). De Poetica. *The basic works of Aristotle.* New York: Random House.

Meier, B. P., Hauser, D. J., Robinson, M. D., Friesen, C. K., & Schjeldahl, K. (2007). What's "up" with God? Vertical space as a representation of the divine. . *Journal of Personality and Social Psychology, 93*(5), 699-710. doi: 10.1037/0022-3514.93.5.699

Meier, B. P., & Robinson, M. D. (2004). Why the sunny side is up: Associations between affect and vertical position. *Psychological Science, 15*(4), 243-247. doi: 10.1111/j.0956-7976.2004.00659.x

Meier, B. P., & Robinson, M. D. (2005). The metaphorical representation of affect. . *Metaphor and Symbol, 20*, 239-257.

Meier, B. P., & Robinson, M. D. (2006). Does "feeling down" mean seeing down?: Depressive symptoms and vertical selective attention. *Journal of Research in Personality, 40*, 451-461. doi: 10.1016/j.jrp.2005.03.001

Meier, B. P., Robinson, M. D., & Clore, G. L. (2004). Why good guys wear white: Automatic inferences about stimulus valence based on brightness. *Psychological Science, 15*(2), 82-87. doi:10.1111/j.0963-7214.2004.01502002.x

Meier, B. P., Robinson, M. D., Crawford, L. E., & Ahlvers, W. J. (2007). When" light" and" dark" thoughts become light and dark responses: Affect biases brightness judgments. *Emotion, 7*(2), 366. doi: 10.1037/1528-3542.7.2.366

Microsoft.com. (2012). Design concepts - visual hierarchy. Retrieved 8 November 2012, 2012, from http://msdn.microsoft.com/en-us/library/windows/desktop/aa511279.aspx

Murphy, G. L. (1996). On metaphoric representation. *Cognition, 60*(2), 173-204. doi: 10.1016/0010-0277(96)00711-1

Oakley, T. (2009). *From attention to meaning: Explorations in semiotics, linguistics and rhetoric*. Bern: European Academic Publishers.

Pecher, D., Van Dantzig, S., Bot, I., Zanolie, K., & Huber, D. E. (2010). Congruency between word position and meaning is caused by task-induced spatial attention. *Frontiers in Psychology, 1*, 1-8. doi: 10.3389/fpsyg.2010.00030

Posner, M. I. (1980). Orienting of attention. *Quarterly Journal of Experimental Psychology, 32*(1), 3-25. doi: 10.1080/00335558008248231

Posner, M. I., Snyder, C. R., & Davidson, B. J. (1980). Attention and the detection of signals. *Journal of Experimental Psychology: General, 109*(2), 160-174. doi: 10.1037/0096-3445.109.2.160

Purkis, H., Lipp, O., Edwards, M., & Barnes, R. (2009). An increase in stimulus arousal has differential effects on the processing speed of pleasant and unpleasant stimuli. *Motivation and Emotion, 33*(4), 353-361. doi: 10.1007/s11031-009-9144-2

Ristic, J., & Kingstone, A. (2009). Rethinking attentional development: reflexive and volitional orienting in children and adults. *Developmental Science*, *12*(2), 289-296. doi: 10.1111/j.1467-7687.2008.00756.x

Robinson, M. D., & Compton, R. J. (2006). The automaticity of affective reactions: Stimulus valence, arousal, and lateral spatial attention. *Social Cognition, 24*(4), 469-495. doi: X

Robinson, M. D., Storbeck, J., Meier, B. P., & Kirkeby, B. S. (2004). Watch out! That could be dangerous: Valence-arousal interactions in evaluative processing. *Personality and Social Psychology Bulletin, 30*, 1472-1484. doi:10.1177/0146167204266647

Rokke, P. D., Arnell, K. M., Koch, M. D., & Andrews, J. T. (2002). Dual-task attention deficits in dysphoric mood. *Journal of Abnormal Psychology, 111*(2), 370-379. doi: 10.1037/0021-843x.111.2.370

Rowe, G., Hirsh, J. B., & Anderson, A. K. (2007). Positive affect increases the breadth of attentional selection. *Proceedings of the National Academy of Sciences*, *104*(1), 383-388. doi:10.1073/pnas.0605198104

Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, *110*(1), 145-172. doi: 10.1037/0033-295x.110.1.145

Sakaki, M., Niki, K., & Mather, M. (2012). Beyond arousal and valence: the importance of the biological versus social relvance of emotional stimuli. *Cognitive and Affective Behavioural Neuroscience, 12,* 115-139. doi: 10.3758/s13415-011-0062-x

Schall, S., Benton, J., & Harvey, S. (2008). With a clean conscience: Cleanliness reduces the severity of moral judgements. *Psychological Science* (19), 1219-1222. doi: 10.1111/j.1467-9280.2008.02227.x

Schmitz, T. W., De Rosa, E., & Anderson, A. K. (2009). Opposing Influences of Affective State Valence on Visual Cortical Encoding. *The Journal of Neuroscience*, *29*(22), 7199-7207. doi: 10.1523/jneurosci.5387-08.2009

Schubert, T. W. (2005). Your highness: vertical positions as perceptual symbols of power. *Journal of Personality and Social Psychology 89*(1), 1-21. doi: 10.1037/0022-3514.89.1.1

Schwarz, N., & Clore, G. L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology, 45*(3), 513-523. doi: 10.1037/0022-3514.45.3.513

Šetić, M., & Domijan, D. (2007). The influence of vertical spatial orientation on property verification. *Language and Cognitive Processes, 22*(2), 297-312. doi: 10.1080/01690960600732430

Storbeck, J., & Clore, G. L. (2008). Affective arousal as information: How affective arousal influences judgments, learning, and memory. *Social and Personality Psychology Compass, 2*(5), 1824-1843. doi: 10.1111/j.1751-9004.2008.00138.x

Tulving, E., & Schacter, D. (1990). Priming and human memory systems. *Science*, *247*(4940), 301-306. doi:10.1126/science.2296719

Wadlinger, H. A., & Isaacowitz, D. M. (2006). Positive mood broadens visual attention to positive stimuli. *Motivation and Emotion, 30*(1), 87-99. doi: 10.1007/s11031-006-9021-1

Wapner, S., Werner, H., & Krus, D. M. (1957). The effect of success and failure on space localization. *Journal of Personality, 25*(6), 752-756. doi: 10.1111/j.1467-6494.1957.tb01563.x

Winkielman, P., Niedenthal, P. M., & Oberman, L. (2009). The embodied emotional mind. In G. Semin & E. R. Smith (Eds.), *Embodied grounding: Social, cognitive, affective and neuroscientic approaches.* New York: Cambridge University Press. Retrieved from http://ebookbrowse.com/winkielman-niedenthal-oberman-pdf-d67824656

Yiend, J. (2010). The effects of emotion on attention: A review of attentional processing of emotional information. *Cognition & Emotion, 24*(1), 3-47. doi: 10.1080/02699930903205698

Yu, N. (1995). Metaphorical Expressions of Anger and Happiness in English and Chinese. *Metaphor & Symbolic Activity, 10*(2), 59. doi:10.1207/s15327868ms1002_1

Appendix A1

Verbal Instructions – Experiment 1

- All participants were asked to adjust their computer screen so the centre of the screen is at eye-height

  "Today's task has two parts. The first is a computer based task and the second is a brief paper and pencil memory task.

  For the computer based task:

  - Some words will appear **at either the top or the bottom** of your screen.
  - You will be asked to **judge whether the word was pleasant or unpleasant** by pressing either the **'u' key (for unpleasant) or the 'p' key** for pleasant. Please place your left index finger on the 'u' key and your right index finger on the 'p' key.
  - You need to respond as **quickly** and **accurately** as possible.
  - There will be a set **of 10 trial words** at the beginning to help you get the idea of what to do.
  - You will then do **a block of responses** that will last about 5 minutes. There will be a **one minute** break, and then you will get a **second block** of responses that again will take about 5 minutes. Please remain quiet in the break as others may still be working.

  For the paper-based task:

  - At the end of the second block of computer-based responses, you will have **3 minutes to write down** as many words as you can remember that you saw on the screen. You can write them down on the recall sheet provided. Again, please remain quiet until the experiment is complete."

- Ask them **to read through and sign** the consent form.
- An opportunity for questions was provided.
- Ask them to note down their age and circle male/female in the space provided on the recall sheet.
- "Please begin."

Appendix A2

Verbal Instructions – Experiment 2

- All participants were asked to adjust their computer screen so the centre of the screen is at eye-height

  "Today's task has two parts. The first is a computer based task and the second is a brief paper and pencil memory task.

  For the computer based task:

  - Some words will appear very briefly (for around half a second) in the **middle of your screen**. A **target item (a letter 'p' or 'q')** will then appear at the top or bottom of your screen.
  - You need to respond as **quickly** and **accurately** as possible, by pressing either the 'p' or the 'q' to indicate what the target letter is.
  - There will be a set **of 10 trial words** at the beginning to help you get the idea of what to do.
  - You will then do **a block of responses** that will last about 5 minutes. There will be a **one minute** break, and then you will get a **second block** of responses that again will take about 5 minutes. Please remain quiet in the break as others may still be working.

  For the paper-based task:

  - At the end of the second block of computer-based responses, you will have **3 minutes to write down** as many words as you can remember that you saw on the screen. You can write them down on the recall sheet provided. Again, please remain quiet until the experiment is complete."

- Ask them **to read through and sign** the consent form.
- An opportunity for questions was provided.
- Ask them to note down their age and circle male/female in the space provided on the recall sheet.
- "Please begin."

Appendix A3

Verbal Instructions – Experiment 3

- All participants were asked to adjust their computer screen so the centre of the screen is at eye-height

  "Today's task has two parts. The first is a computer based task and the second is a brief paper and pencil memory task.

  For the computer based task:

  - Some words will appear very briefly (for around half a second) in the **middle of your screen**. A **target item (a letter 'p' or 'q')** will then appear at the top or bottom of your screen.
  - You need to respond as **quickly** and **accurately** as possible, by pressing either the 'p' or the 'q' to indicate what the target letter is.
  - There will be a set **of 10 trial words** at the beginning to help you get the idea of what to do.
  - You will then do **a block of responses** that will last about 5 minutes. There will be a **one minute** break, and then you will get a **second block** of responses that again will take about 5 minutes. Please remain quiet in the break as others may still be working.

  For the paper-based task:

  - Each of you has a sheet of paper beside you with **two columns** on it. **One is marked 'pleasant' and the other is marked 'unpleasant'**.
  - When you are finished the computer based task, I will ask you to commence the paper-based task. Your job is to **recall as many words as you can that appeared on the screen and place them in the correct column – pleasant or unpleasant**. While in the first task you need to focus on responding to the target letters as fast as possible, I suggest as each word appears on the screen, **you very quickly evaluate whether you think the word is pleasant or unpleasant,** as that will help you recall the words and place them in the right columns in the second task.
  - Again, please remain quiet until the experiment is complete.

- Ask them **to read through and sign** the consent form.
- An opportunity for questions was provided.
- Ask them to note down their age and circle male/female in the space provided on the recall sheet.
- "Please begin."

Appendix B – Trial Words

Word	Valence Rating (mean)	Arousal Rating (mean)
beautiful	7.60	6.17
freedom	7.58	5.52
knowledge	7.58	5.92
puppy	7.56	5.85
talent	7.56	6.27
malaria	2.40	4.19
selfish	3.25	5.33
tomb	3.44	4.35
blackmail	3.00	5.20
bored	2.82	2.88

Word	Valence Rating (mean)	Arousal Rating (mean)
stove	4.98	4.51
rattle	5.03	4.36
scissors	5.05	4.47
pig	5.07	4.20
serious	5.08	4.00
trunk	5.09	4.18
appliance	5.10	4.05
clock	5.14	4.02
journal	5.14	4.05
tool	5.19	4.33

Appendix C – Experimental Words by Category

High Valence – High Arousal

Word	Valence Rating (mean)	Arousal Rating (mean)
triumphant	8.82	6.78
love	8.72	6.44
loved	8.64	6.38
miracle	8.60	7.65
joy	8.60	7.22
laughter	8.45	6.75
affection	8.39	6.21
mother	8.39	6.13
win	8.38	7.72
cash	8.37	7.37
fun	8.37	7.22
orgasm	8.32	8.10
romantic	8.32	7.59
victory	8.32	6.63
success	8.29	6.11
treasure	8.27	6.75
kiss	8.26	7.32
happy	8.21	6.49
promotion	8.20	6.44
graduate	8.19	7.25
lucky	8.17	6.53
terrific	8.16	6.23
valentine	8.11	6.06
joke	8.10	6.74
cheer	8.10	6.12
thrill	8.05	8.02
sex	8.05	7.36
passion	8.03	7.26
millionaire	8.03	6.14
rollercoaster	8.02	8.06
sexy	8.02	7.36
engaged	8.00	6.77
diploma	8.00	5.67
ecstasy	7.98	7.38
confident	7.98	6.22
aroused	7.97	6.63
fame	7.93	6.55
party	7.86	6.69
birthday	7.84	6.68
gift	7.77	6.14
sunlight	7.76	6.10
outstanding	7.75	6.24
pretty	7.75	6.03
admired	7.74	6.11
car	7.73	6.24

progress	7.73	6.02
rescue	7.70	6.53
riches	7.70	6.17
desire	7.69	7.35
profit	7.63	6.68
leader	7.63	6.27

High Valence – Low Arousal

Word	Valence Rating (mean)	Arousal Rating (mean)
pillow	7.92	2.97
peace	7.72	2.95
untroubled	7.62	3.89
secure	7.57	3.14
wise	7.52	3.91
bed	7.51	3.61
warmth	7.41	3.73
cozy	7.39	3.32
gentle	7.31	3.21
bird	7.27	3.17
sleep	7.20	2.80
politeness	7.18	3.74
butterfly	7.17	3.47
comfort	7.07	3.93
safe	7.07	3.86
relaxed	7.00	2.39
nectar	6.90	3.89
dove	6.90	3.79
silk	6.90	3.71
leisurely	6.88	3.80
lake	6.82	3.95
flower	6.64	4.00
cottage	6.45	3.39
tree	6.32	3.42
tidy	6.30	3.98
clouds	6.18	3.30
fish	6.04	4.00
orchestra	6.02	3.52
plant	5.98	3.62
milk	5.95	3.68
window	5.91	3.97
horse	5.89	3.89
lamb	5.89	3.36
poetry	5.86	4.00
humble	5.86	3.74
owl	5.80	3.98
modest	5.76	3.98
moment	5.76	3.83
prairie	5.75	3.41
salad	5.74	3.81

key	5.68	3.70
circle	5.67	3.86
jelly	5.66	3.70
golfer	5.61	3.73
windmill	5.60	3.74
unit	5.59	3.75
quiet	5.58	2.82
cow	5.57	3.49
method	5.56	3.85
bathroom	5.55	3.88
museum	5.54	3.60
farm	5.53	3.90

Low Valence – High Arousal

Word	Valence Rating (mean)	Arousal Rating (mean)
crash	2.31	6.95
violent	2.29	6.89
humiliate	2.24	6.14
crucify	2.23	6.47
divorce	2.22	6.33
devil	2.21	6.07
hostage	2.20	6.76
victim	2.18	6.06
detest	2.17	6.06
thief	2.13	6.89
pain	2.13	6.50
hate	2.12	6.95
demon	2.11	6.76
bomb	2.10	7.15
toxic	2.10	6.40
trauma	2.10	6.33
stress	2.09	7.45
leprosy	2.09	6.29
war	2.08	7.49
accident	2.05	6.26
unfaithful	2.05	6.20
assault	2.03	7.51
despise	2.03	6.28
afraid	2.00	6.67
bankrupt	2.00	6.21
hatred	1.98	6.66
poison	1.98	6.05
distressed	1.94	6.40
disloyal	1.93	6.56
terrible	1.93	6.27
drown	1.92	6.57
nightmare	1.91	7.59
killer	1.89	7.86
pollute	1.85	6.08

slave	1.84	6.21
mutilate	1.82	6.41
abuse	1.80	6.83
tragedy	1.78	6.24
ulcer	1.78	6.12
rabies	1.77	6.10
disaster	1.73	6.33
terrified	1.72	7.86
terrorist	1.69	7.27
betray	1.68	7.24
slaughter	1.64	6.77
torture	1.56	6.10
suffocate	1.56	6.03
murderer	1.53	7.47
cancer	1.50	6.42
rejected	1.50	6.37
rape	1.25	6.81

Low Valence – Low Arousal

Word	Valence Rating (mean)	Arousal Rating (mean)
unhappy	1.57	4.18
sad	1.61	4.13
gloom	1.88	3.83
sick	1.90	4.29
discomfort	2.19	4.17
stench	2.19	4.36
malaria	2.40	4.40
deformed	2.41	4.07
trash	2.67	4.16
obesity	2.73	3.87
coward	2.74	4.07
fever	2.76	4.29
germs	2.86	4.49
blister	2.88	4.10
waste	2.93	4.14
bored	2.95	2.83
stink	3.00	4.26
dreary	3.05	2.98
blind	3.05	4.39
inferior	3.07	3.83
ignorance	3.07	4.39
manure	3.10	4.17
messy	3.15	3.34
idiot	3.16	4.21
mildew	3.17	4.08
impair	3.18	4.04
moody	3.20	4.18
dump	3.21	4.12
urine	3.25	4.20

feeble	3.26	4.10
false	3.27	3.43
nuisance	3.27	4.49
fatigued	3.28	2.64
handicap	3.29	3.81
mucus	3.34	3.41
pity	3.37	3.72
grime	3.37	3.98
dummy	3.38	4.35
immature	3.39	4.15
fault	3.43	4.07
crutch	3.43	4.14
mold	3.55	4.07
overcast	3.65	3.46
noose	3.76	4.39
resent	3.76	4.47
weary	3.79	3.81
hinder	3.81	4.12
cell	3.82	4.08
rusty	3.86	3.77
timid	3.86	4.11
detached	3.86	4.26