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When the sunny side is down: Re-mapping the relationship between direction and valence

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Abstract
Lakoff & Johnson (1999) argue that the understanding of positive or negative concepts is structured around our sensorimotor experience whereby "Happy is up" and "Sad is down". Consistent with this, Meier and Robinson (2004) found that positive evaluations of words gave faster responses to spatial probes in an upper region of space compared to lower regions of space, and vice versa for negative evaluations. However, "She blew her top" or "He dropped his grudge" are both common metaphors despite reversing the basic mapping. Using Meier and Robinson's (2004) paradigm, we generated "negative-up" and "positive-down" phrases. Results showed a probe position x valence interaction in the opposite direction to that found by Meier and Robinson (2004). This suggests the relationship between direction and valence is not necessarily a single mapping, as envisaged by Lakoff & Johnson (1999).

Keywords: embodied cognition, conceptual metaphor theory, spatial attention.

The debate over the role of bodily states in emotion experience has a long and distinguished history (Lange & James, 1922; Zajonc & Markus, 1984). While it is difficult to imagine the experience of emotion without associated bodily changes, the exact role of bodily states in the processing of emotion concepts remains unclear. This issue has gained momentum in recent years in part due to the emergence of theories of embodied cognition (Barsalou, 1999; Lakoff & Johnson, 1999; Varela, Thompson, & Rosch, 1993). These theories suggest that cognitive representations of body state information are activated to support higher cognitive processes, including language and conceptual processing.

These ideas from embodied cognition align well with converging evidence for the role of bodily feedback in the processing of emotional material (For a review see Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005). Findings include the impact of head movements on word recall (Wheeler & Petty, 2001), body postures on affect (Riskind & Gotay, 1982), and facial contractions on humour ratings (Strack, Martin, & Stepper, 1988).

The common factor in these paradigms is the manipulation of online proprioceptive information, and its effect on affective evaluations. In one of the clearest examples, (Strack, et al., 1988) asked participants to either hold a pen between their teeth (contracting the muscles used for smiling), between their lips (inhibiting the same muscles), or in their non-dominant hand (control condition). Participants who held the pen between their teeth subsequently rated cartoons as significantly funnier than those in the other conditions. This effect occurred without participants interpreting the poses in terms of smiling or frowning, and only on affective rather than cognitive evaluations of funniness (i.e. subjective versus objective ratings of amusement).

This finding suggests that activating a particular body state influences affective processing. However, theories of embodied cognition further suggest that a simulation process is used in perceptual, somatovisceral, introspective and motoric brain regions to support higher cognitive processes, including language, thought and decision making (e.g. Damasio, Everitt, & Bishop, 1996; although see Dunn, Dalgleish, & Lawrence, 2006 for a critique). With regard to emotion concepts, Lakoff and Johnson's (1999, 1980) Conceptual Metaphor Theory claims that because emotion concepts like *love* or *hate* have no external referent, they are understood through richer, more experience-based domains. The basic premise is that these concepts are understood through sensorimotor systems by analogical extension, or "primary metaphor". For example the primary metaphor HAPPY IS UP is based on the sensorimotor experience of an upright posture when happy, as opposed to a slumped one when unhappy. This experience structures our conceptualisation of happiness, and manifests in phrases like "She's on top of the world" or "He was over the moon". Crucially, Lakoff and Johnson (1999) propose that understanding the notion of happiness requires accessing the sensorimotor experience of "up". For abstract concepts in general, it is necessary to activate the relevant primary metaphor in order to comprehend the concepts.

Evidence in support of this particular relationship between direction and valence was found in a study by Meier and Robinson (2004). They firstly showed that the evaluation of positive words was faster when they were presented in the upper half

of a computer screen, and negative words evaluated faster in the lower half. In order to discount the idea that this was due to varying both valence and spatial location, a subsequent experiment demonstrated that evaluation of a positive word presented in the centre of the screen resulted in faster responses to spatial probes in an upper region of space compared to lower regions of space, and vice versa for negative evaluations (see also Pecher, Van Dantzig, Boot, Zanolie, & Huber, 2010) The conclusion is that positive evaluations are associated with upper regions of visual space because evaluations are made on the basis of primary metaphors. This idea in itself is not overly contentious, rather more so is Lakoff & Johnson's (1999) further claim that knowledge about abstract concepts is tied directly to the body so that abstract notions are understood directly though motor schemas. From this perspective, attending to the upper region of visual space in this paradigm would be a necessary consequence of a positive evaluation.

This explanation successfully accounts for the fact that a range of positive words can be associated with an upper region of space, and negative words with a lower region of space. However, the conceptual structure for positive and negative meanings is richer than simply an experiential state of up or down. To account for this, Lakoff and Johnson (1999) suggest that conceptual knowledge also contains more complex metaphors that are comprised of combinations of primary metaphors. Although a complex metaphor may not have an independent experiential basis, it is still tied to sensorimotor experience through the primary metaphors. For example, the metaphor HAPPINESS IS A FLUID IN A CONTAINER does not have an obvious sensorimotor experience attached to it. However, the primary metaphor HAPPY IS UP can be analogically extended from simply "up' to liquid in a container going up. This results in expressions like "We were full of joy" or "He was overflowing with happiness". These kinds of explanations are better able to account for both the richness of our emotion concepts, and to maintain a primary sensorimotor experience underpinning them.

While plenty of examples can be called upon to illustrate these connections, our use of language and valenced forms of meaning is even more intricate when other examples are brought into play. One problem with regard to the HAPPY IS UP metaphor is that associations between direction and affect are not always so clear cut as up-positive and down-negative. The phrase "Their affection was deeply rooted" is positive but suggests depth, Phrases like "She blew her top" or "He hit the roof" both imply some link between "up" on a vertical dimension (top/roof) but allied with negative rather positive affect. Indeed, Kövecses (1986) argued for the use of a container metaphor for anger – ANGER IS A RISING FLUID IN A CONTAINER, which accounts for a range of expressions used to capture anger, for example "He

exploded with rage". A second problem involves instances of ambiguity, as when "Taking the moral high ground" can be good or bad depending on personal perspective.

These examples highlight the intricacies in metaphorical expressions, in their relatedness to a primary metaphor, and of the processing of valence in context. The key empirical issue investigated in the current study is the effect of processing 'exception' phrases that describe a relationship between direction and valence, in the opposite direction to that proposed by Lakoff and Johnson's (1999) primary metaphors.

These exception phrases raise an important empirical issue. If affective evaluations reactivate sensori-motor states, and thus prime spatial regions then conflict should arise with such exception phrases. A negative evaluation of "He hit the roof" should prime lower space but this would be in opposition to potential priming of upper space from the physical location of a roof. On the one hand, primary metaphors are based on regularities between the physical world and abstract concepts. Thus it could be expected that the physical description will prevail over abstract valence. On the other hand, if the task is to evaluate valence, Lakoff and Johnson suggest this is necessarily connected to direction. Either the two influences will cancel out or one must prevail over the other. With this in mind, exception phrases were selected on the basis of ratings of their directional content and valence. Thus, the present experiment was designed to determine which outcome holds when exception phrases are used in Meier and Robinsons' (2004) paradigm.

Method

Participants

Twenty-three participants from the Cognition and Brain Sciences Unit's volunteer panel completed ratings of phrases for use in the main study (11 females; *M* = 33.19 years, *SD* = 11.14) and Twenty-eight others (18 females; *M* = 42.12 years, *SD* = 15.14) completed the Meier and Robinson (2004) paradigm. All participants were native English speakers, were between 18 and 65 years of age, and reported no diagnosis of dyslexia in response to a screening question. Participants received an honorarium of £5 (approximately U.S $8 or 6 Euros) per hour for their participation in the project. The study was approved by the local research ethics committee.

Materials

Fifty-seven phrases were initially generated which were considered plausible candidates for associating negative valence with up or positive valence with down (30 positive down and 27 negative up). Phrases were rated for both direction and valence on nine point analogue rating scales. Lakoff and Johnson (1999) make a distinction between concrete and abstract concepts, suggesting that only the latter activate primary, sensorimotor metaphors. For this reason, the direction rating scale was specifically designed to distinguish between physical, concrete direction and abstract, metaphorical direction. Those phrases that described a physical movement of up or down were considered to have stronger directionality, and were therefore rated as "explicit" with respect to direction. Those phrases that described a physical movement on an abstract level were considered to have weaker directionality and were therefore rated as "implicit" with respect to direction. An example of a phrase with physical, explicit direction would be "His dive was competition perfect" (rated as explicit downward) a phrase with abstract, implicit direction would be "She hit the roof" (rated as implicit upward). These phrases were given as part of the verbal instructions to participants to ensure they understood the rating scale and the task requirements. All participants were instructed not to rate the direction on how it made them feel, for example positive phrases making the participant feel "up", but on the direction stated in the phrase.

The rating scale was ranged from 1 = explicit upwards to 9 = explicit downwards, with 5 = neutral. Participants used the numeric key pad to respond according to the rating scale. All participants were asked to rate for direction first, to avoid the confound of valence influencing ratings of direction. Participants were not told about the valence ratings, or given the valence rating scale until they had completed the direction ratings. For the valence ratings the scale was 1 = extremely positive, 9 = extremely negative and 5 = neutral. Phrases were presented visually on a 17 inch computer screen, in courier new font black type (18pt), participants gave their responses on a standard computer keyboard. They were also given a laminated A4 paper version of each rating scale for reference.

From the candidate materials, 40 test phrases were selected. Twenty phrases were selected with ratings in the upper range for positive valence (1 – 4.5) coupled with ratings indicating downward direction. Since Lakoff & Johnson (1999) argue that only abstract meanings invoke simulations, we excluded any statement rated as having fully concrete meanings as indexed by a rating of 9. Hence, for the "positive-down" phrases the direction ratings were in the range 5.5-8. These selection criteria were mirrored for our negative up phrases. For the negative phrases the valence

ratings had a range of 5.5 – 9. For direction, they excluded the most concrete rating for upward direction (1), with "up" ratings all between 2 – 4.5. The ranges for both exclude any material at or around the midpoint of the full range for both valence and direction.

For the negative phrases, the main types of negative meaning used the anger metaphor "She blew her top", or through the level of a negative concept increasing "His debts were rising". For the positive phrases the main types of positive meaning were created through a negative concept decreasing "The patient's fever subsided" or through the concept of positive depth "They had a deep rooted loyalty to her". Phrases were matched for number of words in each phrase (Positive: M = 5.10, SD = 1.02; Negative: M = 4.95, SD = 1.15). The 20 exception negative statements selected for the main experimental trials (e.g. "Pollution levels were spiralling") clearly differed from the twenty positive ones (e.g. "The patient's fever subsided") on valence $t(19) = 14.74$, $p < .001$, $d = 5.42$ (Positive: M = 3.15, SD = 0.68; Negative: M = 7.05, SD = 0.77) and direction $t(19) = 23.12$, $p < .001$, $d = 7.33$ (Positive: M = 6.86, SD = 0.64; Negative: M = 3.05, SD = 0.33) ratings. For the practice trials, direction was again associated with valence, but to less strict criteria, given the limited number of phrases that could be designed with an abstract direction component.

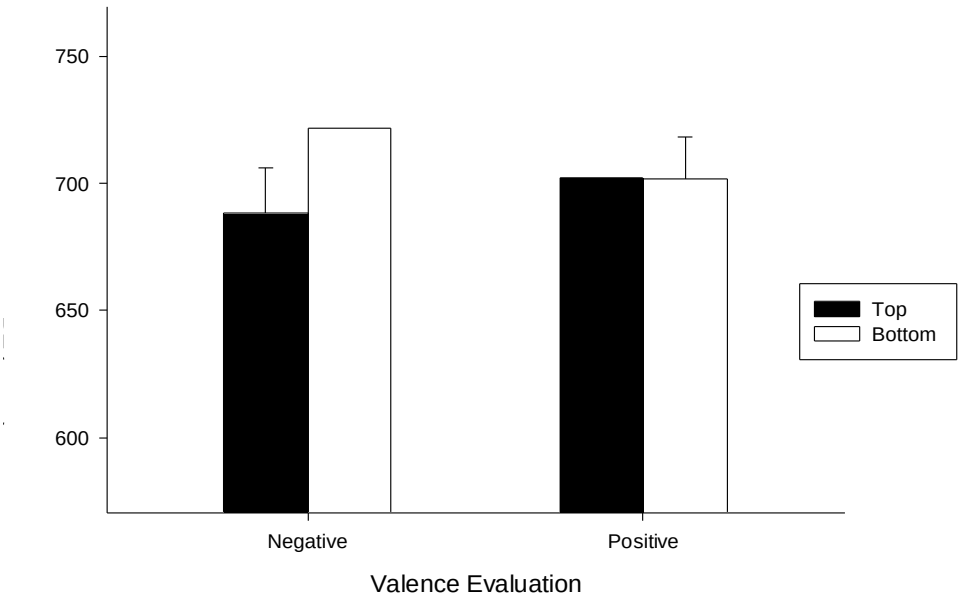
Design and procedure

A 2 (Valence: positive, negative) x 2 (Probe Position: top, bottom) repeated measures design was employed. The procedure followed Meier and Robinson (2004), Study 3. Each phrase appeared in the centre of a computer screen. Participants were asked to judge each in terms of positive or negative meaning. Judgements were verbal, recorded by the Experimenter, and synchronized with pressing the space bar. A letter probe (p or q) was then presented in the top or bottom half of the screen with no intervening interval. The timed response was for pressing the equivalent letter on the keyboard. The average time to evaluate the positive phrases was 1975 ms (SD = 218ms), the average time to evaluate negative phrases was 1939 ms (SD = 270ms), this difference was not significant $t(19) = -0.50$, $p = 0.62$. Twenty practice trials were followed by two blocks of forty trials, with each phrase being probed in one position in one block and the alternate position in the other. Phrase order was randomized for each participant with probe location and block order counterbalanced.

Results

Following Meier and Robinson (2004), the dependent variable was reaction time (RT) to the probes. Inaccurate trials were discarded and RTs 2.5 *SD* above/below the grand mean replaced by the 2.5 *SD* value. On average 4.13 (*SD* = .67) data points were replaced per participant. The data are presented in Figure 1. There was no main effect of Valence $F(1,27) = 0.11$, $MSE = 2145.607$ $p = .741$. The main effect of Probe Position was significant $F(1,27) = 6.73$, $MSE = 1125.00$ $p = 0.015$ $\eta^2 = .87$, whereby cues in the upper half of the screen were responded to 16 ms faster than those in the lower half of the screen. Finally, the Probe Position x Valence interaction was significant $F(1,27) = 6.29$, $MSE = 1252.75$ $p = 0.02$ $\eta^2 = .86$. Paired t-tests showed no difference in RTs to top and bottom probes following positive phrases $t(27) = -.04$, $p = .97$. However, for the negative phrases, participants were 33ms faster to respond to a subsequent Probe in the upper half of the screen than in the lower half, $t(27) = 3.44$, $p = .002$, $d = .66$. Paired t-tests were also carried out on each probe location, there was no difference between positive and negative phrases with regard to subsequent response times to probes in the upper half of the screen $t(27) = 1.32$, $p = 0.20$, however, there was a trend for slower response times to probes in the lower half of the screen following negative phrases compared to positive phrases $t(27) = 1.71$, $p = 0.09$.

Figure 1: Interaction between probe position (top/bottom) and valence for exception phrases. Error bars show standard error of the difference.



Discussion

Using phrases rated for directional and valenced meaning, the results indicate that no single mapping is necessarily invoked between direction and affect. The overall interaction reported here between valence and regions of space is in the opposite direction to that found for isolated words by Meier and Robinson (2004) with the same task requirements for valence evaluation and responding. While the present results are essentially a mirror image of those of Meier and Robinson (2004), it is notable that both sets of data are asymmetric, with effects most marked for negative stimuli. This asymmetry may provide important clues as to the boundary conditions for particular patterns of outcome.

The absence of a difference in priming attention to upper and lower regions of space with positive phrases, contrasts with some other related findings from psycholinguistics. For example, Stanfield & Zwaan (2001) presented participants with phrases that suggested either a vertical or a horizontal orientation for an object, they found that verification of that object in a subsequent picture was faster when the orientation implied in the phrase was congruent with the orientation of the object in the picture. However, in the current study, direction was only relevant to the extent that it was associated with valence. This raises the issue of exactly how the directional descriptions in our phrases were related to valenced interpretations.

Although the positive and negative phrases were matched on our key design variables, there were nonetheless differences between them in terms of the states they described. Notably, some of the negative phrases made use of the anger metaphor, whereas positive phrases tended to rely either on the lowering of a negative component, or on the positive semantics associated with depth. Where the anger metaphor was used, it could be argued that reversal of the direction x valence interaction is broadly consistent with Lakoff and Johnson's (1999) theoretical account.

Although the evaluation of negative valence may not have activated a downwards simulation, faster reaction times to probes in the top location could still be consistent with upwards simulation as part of the processing of anger metaphor phrases. That is, where the experiential state described in the phrase is compatible with the valence of the underlying metaphor, then any such priming would override the expected priming from valence evaluation alone. Consider the ANGER IS A RISING FLUID IN A CONTAINER metaphor. While this does not appear to have a direct relationship to a sensorimotor metaphor, a connection could arise based on the primary experiences

of anger resulting in a raised body temperature, or "heat" and the upwards physical actions associated with anger. Thus "up" is connected both to physical temperature and bodily actions. The same argument would apply for phrases like "He blew his top" and "She was boiling over with rage". Where the association between the sensorimotor experiences of "up" and negativity already exist, it is plausible that the other negative phrases activated the same underlying metaphors via a more schematic process rather than a trial by trial basis.

A second potential contributor to the valence asymmetry is processing conflict. This may have arisen with those positive phrases involving a negative concept decreasing. Where the task is to evaluate valence, presentation of "Crime levels were lowering" may have activated initial negative associations from "crime" that are incongruent with the overall meaning of the phrase when later combined with "were lowering". There is evidence that incongruencies such as these can give rise to inhibitory effects. Using negated phrases, Kaup, Yaxley, Madden, Zwaan, and Lüdtke, (2006) reported evidence that when participants are presented with "The eagle was not in the sky", the shape of the eagle was still simulated - even when it did not map on to a real world instance. They concluded that the eagle would be simulated in the earlier stages of processing, but then inhibited when the real world inferences were drawn from the phrase. Our positive exception phrases could well have initially activated the simulation of direction physically present in the phrase, only to have this subsequently inhibited during the process of evaluating valence. For the negative phrases, where the valence and direction in the metaphor were consistent, this overruled the activation of direction based on simple valence. This, in addition to the absence of an underlying metaphor for the positive phrases, suggests two possible reasons why the mapping was not reversed on positive phrases.

The potential complexity in processing these phrases, points to an overlap with embodied approaches to narrative text comprehension (for a review see Gibbs, 2006). For instance, MacWhinney (1998) proposes that people create meaningful construals by incrementally using their embodied experiences to "soft assemble" meaning, rather than activating pre-existing conceptual representations. However, further research would be needed to clarify the conditionality of primary metaphor activation, in particular, the impact of contextual factors and the role of incremental processing and suppression of sensorimotor simulations. Nonetheless, the current study points to both the complexity inherent in the structure of emotion concepts in general, and specifically, to considerable plasticity in the mapping between direction and affect.

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