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On the Ups and Downs of Emotion: Testing between conceptual metaphor and polarity accounts of emotional valence-spatial location interactions

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Abstract

In the past decade there have been many studies examining the relationship between emotional valence and vertical spatial positions from a processing perspective. Lakoff and Johnson's (1980) work on conceptual metaphor has traditionally motivated these investigations, but recent work (Lakens, 2012) suggests that polarity-based perspectives offer an alternative account of response-time patterns. We contrast the predictions of these two theories using a new facial emotion recognition task, where participants made speeded responses to happy or sad faces on a display, with the spatial location of those faces being manipulated. In three experiments (two-alternative forced-choice tasks and a go/no-go task), we found a pattern of responses consistent with a polarity-based account, but inconsistent with key predictions of the conceptual metaphor account. Overall, congruency effects were observed for positively valenced items, but not for negatively valenced items. These findings demonstrate that polarity effects extend to non-linguistic stimuli and beyond two-alternative forced-choice tasks. We discuss the results in terms of common-coding approaches to task/response mappings.

Keywords: emotion recognition, conceptual metaphor, spatial congruency, representation, polarity

There are many physical and bodily manifestations of affect that have strong spatial associations. Good things are generally considered to be "up" and bad things "down" (Lakoff & Johnson, 1980), with these associations scattered liberally throughout language (e.g., *things are looking up, down in the dumps*). It is usually assumed that such mappings between affect and space emerge through 'embodied' experiences of positive and negative events. For example, when in a positive mood, one tends to stand upright, adopting a more slouched posture when depressed (LaFrance & Mayo, 1978). In contrast with this dominant 'conceptual metaphor' framework, an alternative account has been proposed in terms of polarity effects (Lakens, 2012). Here, we test between these rival accounts through competing response-time predictions in a novel task examining the relationship between affective valence and location in vertical space.

Conceptual Metaphor Theory Versus Polarity

Conceptual metaphor theory (Lakoff & Johnson, 1980) has been used to describe how space/valence relations emerge and to motivate many empirical studies linking affect and verticality. In one of the first empirical demonstrations of the "GOOD is UP" conceptual metaphor, Meier and Robinson (2004) found that people are faster to judge positively valenced words (e.g., *champion, witty*) when they appear in a high spatial location compared to a low location, while they are faster to judge negatively valenced words (e.g., *spider, liar*) when they are in a low location compared to a high one. Related work has revealed similar patterns (e.g., Meier, Hauser, et al., 2007; Schubert, 2005), with faster performance for congruent trials (positive–UP/negative–DOWN) compared to incongruent trials (positive–DOWN/negative–UP).

Such results are often taken as evidence that the valence of words automatically activates congruent vertical location information in the minds of participants.

Recently, an alternative, polarity–based explanation of these associations has been developed (e.g., Lakens, 2012; see also Santiago, et al., 2012). Rather than considering the metaphoric congruency between the conceptual content of a stimulus (e.g., a positive/negative word) and its spatial location (e.g., high/low in the visual field), one can instead consider the various structural dimensions involved in a task or judgement (e.g., stimulus content, spatial location, response code etc.), and the overlap in relational structure between these dimensions. Each dimension in the task has a default endpoint that is considered +polar, and an opposing endpoint considered –polar (Proctor & Cho, 2006). For example, in relation to emotion the +polar endpoint would be "happy", as it is considered the default, the most frequent, and is the unmarked end of a dimension (one can negate the positive pole: unhappy, but not the negative pole: *unsad). It has been demonstrated that the +polar end of a dimension will induce a processing advantage over the -polar end of that dimension during conceptual processing (Clark, 1969; Seymour, 1974; see Hommel et al., 2001 for a related account). Furthermore, the processing benefits due to these dimensions are additive (Lakens, 2012; Seymour, 1974). By summing the +polar and –polar elements involved in a set of task conditions one can make predictions about the relative speed of responses in different experimental conditions. As an extreme example, for a condition where all dimensions are +polar one would expect very fast responses relative to other conditions (see Table 1). Critically, for studies investigating the relationship between valence and vertical space, the polarity–based account makes contrasting predictions to conceptual metaphor theory, allowing us to test between the two. From a conceptual metaphor perspective the expectation is that there will be an interaction effect between stimulus valence and spatial location, with equivalent, symmetrical effects for positive and negative stimuli. The prediction of symmetrical effects is made explicitly by Meier & Robinson (2004, p.244), where they state that positive stimuli will be processed quicker in a high location than in a low location, while negative stimuli will be processed quicker in a low location than in a high location. However, a polarity-based account makes quite different predictions.

For a two–alternative forced-choice response time task, Lakens (2012) identified four key structural dimensions of the task: i) stimulus valence, ii) spatial location of stimulus, iii) response code, and iv) polarity correspondence between the stimulus and its location (Proctor & Cho, 2006). For stimulus valence, people process positively valenced stimuli faster than negatively valenced ones (Meier & Robinson, 2004), therefore positively valenced stimuli are considered +polar in this dimension. For spatial location, high location is coded as +polar, while low location is –polar, as people are quicker to process items associated with higher spatial location than with low spatial locations (Clark & Brownell, 1975; Ladavas, 1988). For bimanual response tasks, responses are explicitly or implicitly coded as YES/NO, POSITIVE/NEGATIVE or TRUE/FALSE. People are faster to make judgements for +polar response codes (yes/true/positive/happy) than –polar responses (no/false/negative/sad: Clark & Brownell, 1975). Finally, the polarity correspondence principle (Proctor & Cho, 2006) suggests that where there is an overlap between the conceptual meaning of the stimulus (i.e., valence) and the perceptual features of the stimulus (e.g., location), a further processing boost is observed (see also Hommel et al., 2001). As Lakens (2012, p. 728) notes, "the polarity correspondence principle predicts that trials where the polarities of the conceptual and perceptual dimensions overlap (+polar words presented UP and –polar words presented DOWN) should receive a processing benefit compared to when the polarities do not overlap (+polar words presented DOWN and –polar words presented UP)".

In a meta-analysis of five previous studies, Lakens (2012) applied these structural mappings and observed that, while the conceptual metaphor account predicts faster responses for congruent conditions and slower responses due to interference in the incongruent conditions, the effects reported in the literature are actually asymmetric, with no support for the influence of spatial location on the processing of negatively valenced stimuli. Further, Lakens demonstrated that the presence or absence of these congruency effects could be dictated by increasing the frequency of negative words in a block, such that negative words now became the default +polar response, something that was not predicted by the conceptual metaphor account.

While Lakens's (2012) findings support polarity as a means of accounting for valence–space interactions in response–time tasks, the weight of empirical support for a conceptual metaphor perspective demands further testing between these accounts. In the current studies we did so, employing emotion–recognition tasks where happy or sad faces appeared on screen in different spatial locations. This provides three important advances over existing work. Firstly, from a conceptual metaphor account the emotion metaphor HAPPY is UP/SAD is DOWN represents the strongest and most frequently cited example of a spatial conceptual metaphor (e.g., Kövecses, 1991; Lakoff & Johnson, 1980), thereby providing a strong test case to contrast theoretical positions. As well as being two of the most commonly used terms related to affect, *happy* and *sad* are also considered to be basic emotions by many researchers (e.g., Batty & Taylor, 2003; Ekman, 1992). Secondly, Lakens (2012) and others have focused solely or primarily on linguistic stimuli in examination of valence and vertical conceptual metaphors (e.g., Meier & Robinson, 2004; Schubert, 2005). The focus on linguistic stimuli is problematic from a conceptual metaphor perspective as the relationships between valenced words and space, for example, may simply represent shared descriptive associations, and thus may not reflect deeper conceptual content (Murphy, 1996). If emotion concepts are represented spatially, rather than merely being described in that way, one should find affect/spatial associations for both linguistic and non-linguistic stimuli (Crawford et al., 2006). The use of facial emotion stimuli also avoids the issue of possible confounds of lexical associations between emotion words and spatial terms (e.g., polarity is related to lexical frequency: Clark, 1969). Furthermore, we know of no other study examining emotion-space interactions that has used facial stimuli, despite the fact that emotion-recognition tasks are paradigmatic in emotion research (e.g., Elfenbein & Ambady, 2002 for meta-analysis). Thus, using facial emotions provides a novel, alternative task domain to lexical processing where the two accounts can be contrasted. Finally, previous response-time studies have generally utilized a two forced–choice alternative paradigm (e.g., judging whether a stimulus is positive OR negative). We adopt this paradigm for two studies (Experiments 1-2), but introduce a Go/No–Go paradigm (Experiment 3), which provides additional contrasting predictions.

The predictions for these tasks from a conceptual metaphor perspective are straightforward: when the spatial location and emotional valence are congruent, response times will be facilitated. However, when they are incongruent (e.g., happy–DOWN) response times will be slowed due to interference between the emotional content of the stimulus and the perceptual location of the image. Further, because of the symmetry of the valence–space relationship, we would expect no difference in response times between the congruent conditions of happy faces in a high location (happy–UP) or sad faces in a low location (sad–DOWN) or the two incongruent conditions of happy faces in a low location (happy-DOWN) or sad faces in a high location (sad-UP).

By summing the polarities of the dimensions involved in each condition, the polarity account makes predictions that contrast with those of the conceptual metaphor account, as follows (see Table 1 for a schematic of the predictions):

1. Happy faces presented UP should be identified more quickly than sad faces presented DOWN. This is because happy faces receive a +polar processing boost from the valence of the stimulus, the stimulus location, polarity correspondence and the fact that people are responding with the +polar response code "happy" (making this the fastest condition), while the sad-DOWN condition receives only a boost from the polarity correspondence between valence and location, but not the valence or location dimensions in isolation (both sad and DOWN are –polar). From a conceptual metaphor view, both congruent conditions should be equivalent.
2. Happy faces are identified more quickly when presented UP than DOWN, but sad faces are identified equally quickly whether presented UP or DOWN. Happy faces presented UP receive a boost from the valence, location, response code and polarity correspondence (as above), while happy faces presented DOWN have +polar valence, but -polar location and –polar polarity correspondence. Sad faces on the other hand receive only a boost from +polar location in the UP position, while only receiving a boost from +polar polarity correspondence in the DOWN location. The conceptual metaphor view would expect sad faces to be judged more quickly when presented DOWN, as this is the metaphorically congruent condition.
3. Sad faces presented DOWN should be identified slower than happy faces presented

DOWN as happy faces receive a +polar boost from stimulus valence and response code, while again, sad faces presented DOWN receive only a boost from the polarity correspondence between valence and location. By contrast, the conceptual metaphor account would expect sad–DOWN faces to be processed more quickly as the condition is metaphorically congruent, while the happy–DOWN condition is metaphorically incongruent.

In three studies we examine empirically whether the conceptual metaphor or polarity accounts provide a better fit for the response-time patterns observed.

Experiment 1: Testing the basic facial emotion–spatial location congruency effect

This experiment tested whether the speed of identification of the emotional expression of a face is affected by the spatial location of the face onscreen.

Method

Participants. Thirty-three undergraduate students participated for course credit.

Materials. Stimuli were 16 faces (8 with happy and sad expressions) matched for the degree of valence they exhibited. Four normed faces were taken from existing databases (FEEST; Young, et al., 2002; JAFFE: et al., 1998) with four additional faces created and matched by independent raters to these normed faces for the degree of happiness/sadness exhibited.

Procedure. Participants identified the emotion of each face as HAPPY or SAD as quickly as possible using their index fingers to depress the A or L keys (located on the horizontal axis of the keyboard to eliminate stimulus–response compatibility effects as possible confounds). For each trial, participants focussed on a central fixation cross that appeared for 500ms, followed by a gap of 500ms, followed by the face. Each face remained onscreen until a response was made, with a 500ms gap from response to the beginning of the next trial. Faces (height=60mm, width=50mm) were presented directly above or below the midpoint of the screen at a distance of 85mm to the midpoint of the face. Each face was presented in high and low locations, repeated in four blocks (fully-randomized, 128 trials total). Response mappings were counterbalanced and switched half-way through (with additional practice trials included prior to test items with the new mapping), thus controlling for possible associations of right with positive states and left with negative states.

Design. The design was a 2 (facial emotion: happy, sad) X 2 (location: UP, DOWN) repeated-measures design. Effect sizes are reported as Cohen's *d*.

Insert Table1 here

Insert Figure 1 here

Results & Discussion

Prior to analyses, incorrect responses (4%) and outliers with response times greater than 2 standard deviations above a participant's mean response time (3%) were removed. There were no main effects or interactions involving error rates here or in the following experiments. The remaining response times were submitted to a 2x2 repeated–measures ANOVA. Overall, faces were identified more quickly when they were in the UP location (M=699ms) than in the DOWN location (M=708ms – $F(1,32)=8.54$, MSe=297, p=.006, d=.11), and happy faces were identified more quickly (M=688ms) than sad faces (M=718ms – $F(1,32)=11.93$, MSe=2476, p=.002, d=.37). The interaction predicted by both conceptual metaphor and polarity–based accounts between emotion and position was also significant, $F(1,32)=6.79$, MSe=414, p=.014, d=.44. For all follow–up pairwise analyses (Experiments 1–3) Holm–Bonferroni corrections are employed (Holm, 1979).

In terms of the three contrasting predictions outlined above, all three were in favor of the polarity–based account. First, happy faces presented UP were identified quicker than sad faces presented DOWN (t=4.356,p<.001,d=.44). Second, while happy faces presented UP were identified quicker than happy faces presented DOWN (t=3.926,p=.002,d=.12), sad faces presented DOWN were processed equally quickly to sad faces presented UP (t<*1*,p=.921). Finally, sad faces presented DOWN were identified more slowly than happy faces presented DOWN (*t=2.394,p*=.046,d=.36), Figure 1.

Overall, the results of Experiment 1 closely follow the predictions of the polarity–based account, suggesting that structural overlap between key task dimensions may underlie effects that have been previously observed in the literature. Nonetheless, there are possible reasons why this study did not exhibit the patterns expected by the conceptual metaphor theory. One possibility is that as the mouth is the main diagnostic cue used to evaluate emotion (Gosselin & Schyns, 2001), participants first perform a saccade to locate the mouth. If this is the case, then for a face in a high location the distance to the mouth in Experiment 1 was shorter in a high position (~71.5mm) than in a low position (~98.5mm), with differences in saccade times (Hoffman, & Subramaniam, 1995) potentially masking an effect for sad faces, while magnifying an effect for happy faces. Therefore, in Experiment 2, distance from fixation point to the midpoint of the mouth, rather than the face, was used to generate the high and low locations of faces.

Experiment 2: Does gradedness of vertical location affect the effect?

As well as attempting to replicate the basic findings of Experiment 1, we also considered whether the degree of aboveness/belowness of the spatial location influenced speed of judgements. It is possible that the lower the location the more negative the state, and vice versa for positive locations/states. To be clear, the conceptual metaphor view does not make explicit predictions regarding gradedness of responses. Nonetheless, there is evidence for graded routes in spatial representation (Kosslyn et al., 1989), but also evidence of categorical processing of valenced stimuli (Estes & Adelman, 2008), which would more closely align with a polarity-based account since +polar and –polar response dimensions are treated categorically (Lakens, Semin & Foroni, 2012).

To determine whether categorical or coordinate/graded information is in evidence in relation to emotion judgements, we manipulated distance in the vertical plane. Faces appeared in one of eight positions; four above the central fixation and four below. Each position above the fixation was equidistant from its below–the–fixation counterpart (i.e., position 1 above the centre was the same distance from the fixation as position 1 below the centre), with distance calculated to the midpoint of the mouth.

If judgements of emotion are graded, then we would predict an interaction between facial emotion, spatial location (UP, DOWN) and distance from the central fixation (i.e., the higher the location of a happy face, the faster the responses made). Alternatively, if such judgements are categorical, then we would expect only the emotion by location interaction that we observed in Experiment 1, with no three–way interaction. As before, we contrast the three critical predictions of the polarity–based account with those of the conceptual metaphor account.

Method

As Experiment 1, with the following exceptions:

Participants. Thirty undergraduates participated for course credit.

Materials. We used the same faces as in Experiment 1, with the addition of one additional pair of faces (one happy, one sad) selected according to the same criteria.

Design. The design was a 2 (emotion: happy, sad) X 2 (location: UP, DOWN) X 4 (distance to mouth: 1, 2, 3 and 4) repeated-measures design.

Procedure. Identical to Experiment 1.

Insert Table 2 here

Results & Discussion

Prior to analyses, incorrect responses (3%) and outliers (4%) were removed using the same criteria as before. Remaining response times were submitted to a 2 (emotion: happy, sad) X 2 (location: UP, DOWN) X 4 (distance; 4 levels of distance from the central fixation) repeated-measures ANOVA – see Table 2 for condition means. There was a significant main effect of facial emotion, $F(1,29)=20.224$, $MSE=20353$, $p<.001$, $d=.66$, with happy faces identified more quickly (M=767ms) than sad faces (M=825ms). There was a marginal main effect of location, $F(1,29)=4.066$, $MSE=4922$, $p=.053$, $d=.11$, with faces appearing in a higher location (M=789ms) identified marginally more quickly than faces in a lower location (M=802ms). There was also a significant main effect of distance, $F(3,87)=9.189$, $MSE=3222$, $p<.001$, with faces in more proximal positions generally identified more quickly than faces in more distal positions – position 1 (M=778ms)=position 2 (M=788ms; $t=1.3, p=.203, d=.08$)<position 3 (M=811ms; $t=3.4, p=.002, d=.18$). There was no difference in response times for positions 3 and 4 (M=807ms, $t<1$). In terms of the three contrasting theoretical predictions, the patterns again followed those of the polarity–based account.

There was a marginal interaction between facial emotion and spatial location, $F(1,29)=3.697$, $MSE=4792$, $p=.064$, $d=.35$. First, happy faces presented UP (M=754ms) were identified more quickly than sad faces presented DOWN (M=826ms, $t=4.878$, $p<.001$, $d=.54$). Secondly, happy faces were identified more quickly when presented UP than DOWN (M=780ms, $t=2.893$, $p=.014$, $d=.22$), but sad faces were processed equally quickly whether presented UP (M=824ms) or DOWN (M=826ms, $t<1$). Thirdly, sad faces presented DOWN were judged slower than happy faces presented DOWN ($t=3.44$, $p=.006$, $d=.37$).

Lastly, there were no reliable interactions between emotion and distance, $F(3,87)=2.049$, $MSE=3509$, $p=0.113$, location and distance ($F<1$) or emotion, location and distance ($F<1$). The absence of a reliable three–way interaction between emotion, location and distance indicates that the size of the emotion–location effect was invariant across proximal and distal locations. This suggests participants' valence judgements were categorical in nature, lending further support to the view that people's responses are driven by the poles of the task dimensions, rather than by gradations along those dimensions: it only mattered that a face appeared above or below the midpoint, and not how much above or below the midpoint its position.

Experiment 3: Go/No–Go Task

In Experiments 1 and 2 we attempted to account for potential stimulus–response compatibility issues by having participants respond in the axis orthogonal to that in which the stimuli of interest were being presented. Despite this, there remains the possibility that some mapping exists between the positive and negative dimensions of both axes (e.g., rightward responses may be more linked either with upward locations or with positive valence). To address this issue and remove any possible mappings between the direction of movement involved in the button press and either the spatial location or the stimulus valence, we adopted a go/no–go paradigm where participants only responded to relevant trials by pressing a single key. Of course, changing the response key alters the response code dimension of the task, thus altering the predictions derived from the polarity–based account, but not those of the conceptual metaphor account. Specifically, the polarity account would predict that there should no longer be a processing time difference between happy faces presented DOWN and sad faces presented UP or DOWN, because now the "Go" response by default becomes the +polar response code. Thus, for blocks where people are responding only to sad faces, the Go response is +polar, just the same as blocks where participants only respond to happy faces, thereby removing response-code differences between these conditions. By contrast, the conceptual metaphor account would still expect sad faces presented DOWN to be identified faster than happy faces presented DOWN, as sad–DOWN represents the metaphorically congruent condition. As before, both accounts expect happy faces presented UP to be faster than happy faces presented DOWN, but where the metaphor account expects sad faces presented DOWN to be faster than sad faces presented UP, the polarity account still expects no difference.

Method

Participants. Twenty-nine undergraduates took part for course credit. One participant's data were removed due to use of the wrong button during the experiment.

Materials. As Experiment 2.

Design. The design was a 2 (facial emotion: happy, sad) X 2 (location: UP, DOWN) within-participants, repeated-measures design, with responses evenly split between happy and sad faces.

Procedure. As Experiment 1 but with the following changes. Participants identified the emotion of each face as HAPPY or SAD as quickly as possible by depressing the 5 key (located in the centre of the number pad of the keyboard). For half of the experiment the participant responded only to happy faces ("go" trials), but not to sad faces ("no-go" trials), while in the second half the participant responded only to sad faces. Order of responding to happy/sad faces was counterbalanced.

Insert Figure 2 here

Results & Discussion

Prior to analyses, incorrect responses (8%) and outliers (4.3%) were removed following the same criteria as before. The remaining data were submitted to a 2x2 repeated-measures ANOVA. The results followed the patterns observed previously. There was a main effect of emotion, $F(1,27)=5.220$, $MSE=3355$, $p=.03$, $d=.43$, with happy faces (M=556ms) identified more quickly than sad faces (M=581ms). There was a main effect of location, $F(1,27)=9.459$, $MSE=996$, $p=0.005$, $d=.34$, with items appearing UP (M=559ms) identified more quickly than those appearing DOWN (M=578ms). As before, there was a significant emotion by location interaction, $F(1,27)=10.955$, $MSE=342$, $p=0.003$, $d=1.24$ (Figure 2).

In terms of the predictions of the competing accounts, happy faces presented UP (M=541ms) were indeed processed more quickly than those presented DOWN (M=571ms, $t=4.979$, $p<.001$, $d=.49$), and in support of the polarity account, there was no difference in response times for sad faces presented DOWN (M=584ms) or UP (M=577ms, $t<1$). For the new prediction, the polarity account is again supported, with no significant differences between happy faces presented DOWN and either sad faces presented UP ($t<1$) or sad faces presented DOWN ($t=1.13$, $p>.5$).

Thus, even when removing possible stimulus–response compatibility effects, the emotion–spatial congruity effect still emerges, and still only for positive facial expressions, with the overall pattern closely following the predictions of the polarity account.

General Discussion

Building on Lakoff and Johnson's work (1980) on conceptual metaphor, many empirical studies have demonstrated important associations between affective valence and spatial representations and evaluations. In three studies, we observed that distinct predictions from the polarity account are borne out, while contrasting predictions from the conceptual metaphor view are not. In particular, we observed an asymmetry not predicted by the metaphor account in all three studies: happy faces were identified more quickly in an UP location than a DOWN location, but there was no difference observed between sad faces in the UP and DOWN locations. Furthermore, in a Go/No–Go paradigm, predicted differences by the conceptual metaphor account between happy and sad faces are not observed (i.e., happy–DOWN=sad–UP=sad–DOWN), even though moving away from a standard 2-alternative forced choice paradigm might be expected to eliminate potential polarity effects (Lakens, 2012). These findings extend previous empirical demonstrations in favor of the polarity account by investigating happy versus sad emotional valence using non-linguistic stimuli, and by testing predictions in two different response-time paradigms. It is important for the polarity account to be extended beyond linguistic stimuli, as polarity asymmetries often correlate with linguistic characteristics of words (e.g., frequency). The results suggest that valence-space interactions may be better characterized by the structural relationship between commonly coded task dimensions, rather than by the metaphoric congruency/incongruency between the stimulus valence and the spatial location.

In terms of the broader relevance of the polarity approach, its predictions have now been tested using a number of different response time paradigms across a number of domains including emotion-recognition, power, valence, divinity and morality (Lakens, 2012). Thus, it is clear that a polarity-based account has explanatory power, but on the basis of existing tests we would not claim that the polarity-perspective will account for all effects that support a conceptual metaphor interpretation (see e.g., Crawford et al., 2006; Giessner & Schubert, 2007; van Quaquebeke & Giessner, 2010). The goal of future research will be to determine the extent to which it can explain the full range of data that have been collected in support of a conceptual metaphor account including examining different metaphoric domains and task paradigms (e.g., Crawford et al., 2006, found that memory for the location of images was influenced by stimulus valence), consideration of the common neural mechanisms that may underlie these judgements (Quadflieg et al. 2011), and understanding how polarities are established during development and learning.

Finally, one might expect (as predicted by the theory of event coding; Hommel et al., 2001) that the various polar dimensions are not necessarily equivalent (as implicitly assumed by Lakens, 2012; Proctor and Cho, 2006), and also that some polar dimensions may be privileged as a function of the task underway. For example, making a judgement about the color of a face may not necessarily produce the same strong pattern of effects as judging the emotion of that face even though the emotion is conveyed by the face when color is being judged (see Frühholz, Jellinghaus & Herrmann, 2011). Consideration of relative strength of different polar dimensions under varying task conditions may enable finer grained distinctions between experimental conditions that would currently be considered equal in terms of processing requirements.

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Figure Captions

Figure 1. Response times for emotion recognition judgement in Experiment 1. The graph illustrates the emotion–spatial congruency effect, but only for happy faces. Here, and elsewhere, error bars represent 95% confidence intervals for within–participant designs (Loftus & Masson, 1994), with values inside the bars representing mean response times (ms), standard errors in parentheses and below, error rates (%) per condition.

Figure 2. Illustration of the asymmetric facial emotion–spatial congruency effect in Experiment 3 Go/No-Go task.

Figure 1.

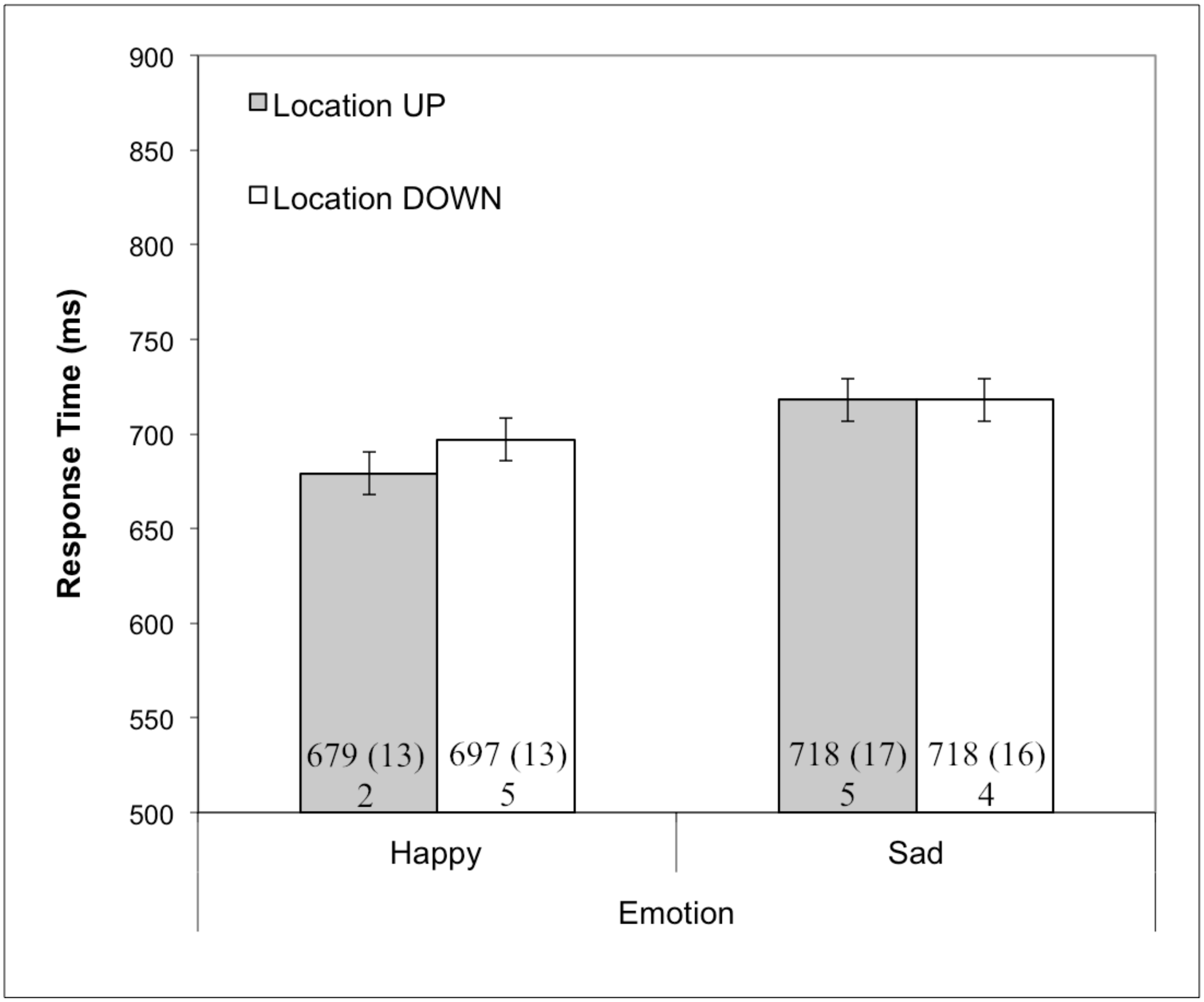

900
850
800
750
700
650
600
550
500
Location UP
Location DOWN
Response Time (ms)
679 (13) 2
697 (13) 5
718 (17) 5
718 (16) 4
Happy
Sad
Emotion

Figure 2

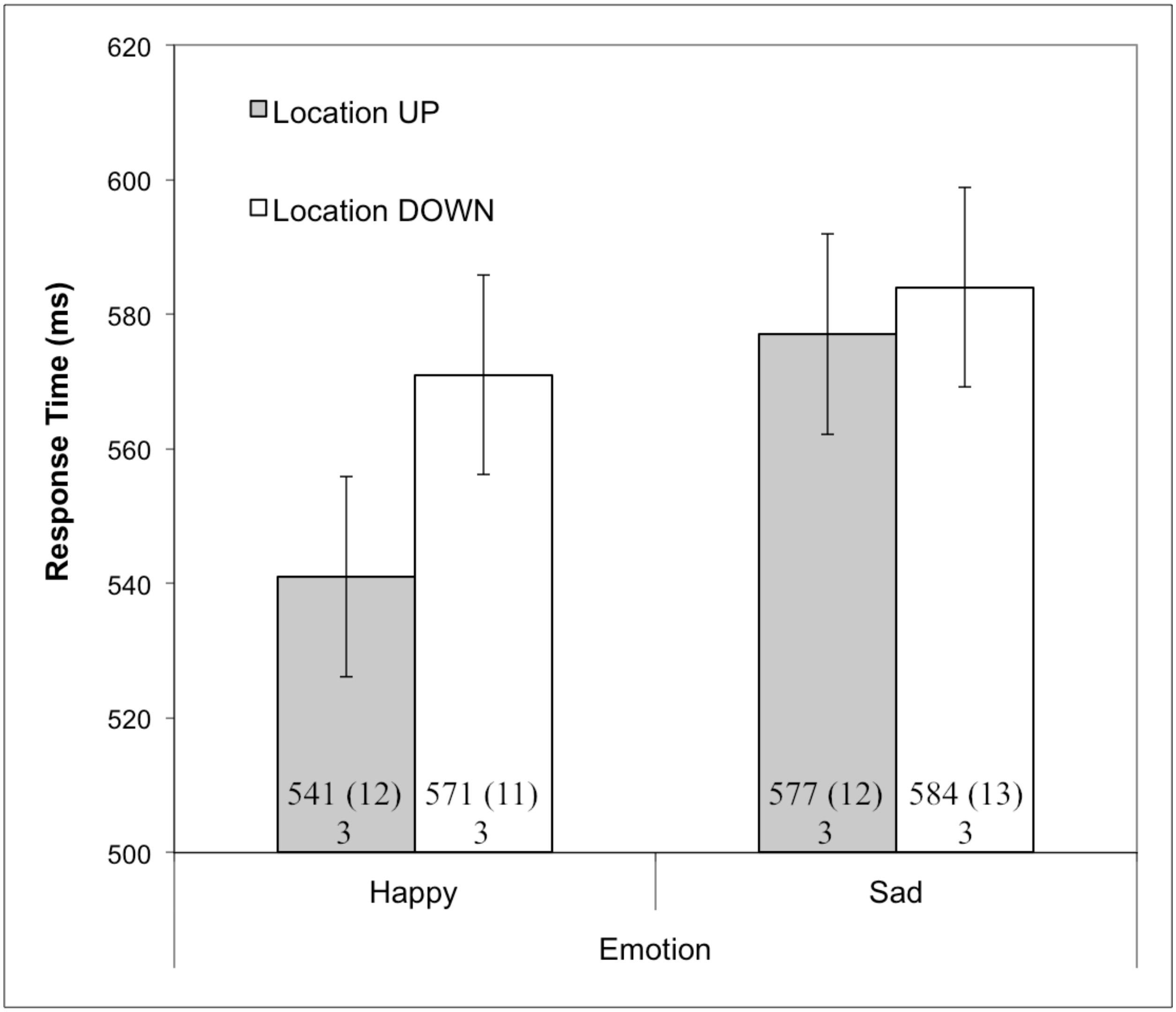
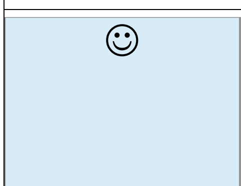
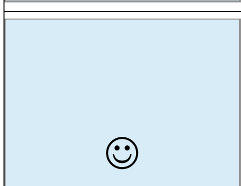
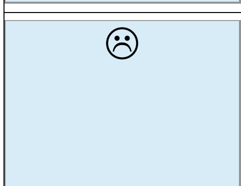

620
600
580
560
540
520
500
Response Time (ms)
Location UP
Location DOWN
541 (12)
3
571 (11)
3
577 (12)
3
584 (13)
3
Happy
Sad
Emotion

Table 1

Schematic of polarity mappings for different conditions in Experiments 1 and 2 (two-alternative forced-choice task, i.e., judge whether the face is happy or sad). The condition column indicates the task condition (e.g., whether a happy/sad face appears in an UP or DOWN location). The task dimensions reflect the polarity of a) the valence of the stimulus/emotion of the face (happy = +polar, sad = –polar), b) the spatial location of the stimulus on screen (UP=+polar, DOWN=-polar, c) the response code of the judgement being made (happy = +polar; sad = –polar), and d) whether there is congruency between the polarity of the stimulus and its spatial location: for example, happy faces presented in the up position are congruent (+polar), while a happy face presented in a low position would be incongruent (–polar). The comments column qualitatively describes the relative speed of responses for each condition. Note that for Experiment 3 (Go/No-Go task) there is only a single response button, meaning the response code dimension has no differential effect on the estimation of processing differences between conditions.

	Task Dimensions				
Condition	Valence	Spatial Location	Response Code	Polarity Correspondence	Comments
	+	+	+	+	Always fastest
	+	–	+	–	Medium
	–	+	–	–	Slow

☹	–	–	–	+	Slow

Table 2

Mean response times (ms), standard errors in parentheses and error rates (%) per condition in Experiment 2. For Distance, 1=nearest to centre, 4=furthest from centre.

		Emotion			
Spatial Location	Distance	Happy		Sad	
		RT	Error	RT	Error
UP	4	766 (20)	2	840 (27)	4
	3	764 (25)	2	841 (31)	4
	2	753 (25)	3	805 (26)	5
	1	733 (26)	3	813 (28)	3
DOWN	1	751 (23)	4	815 (30)	4
	2	786 (24)	6	807 (28)	3
	3	796 (23)	5	843 (25)	4
	4	784 (19)	3	837 (24)	4