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**When Abstract Concepts Rely on Multiple Metaphors:
Metaphor Selection in the Case of Power**

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MULTIPLE METAPHORS OF POWER

Abstract

The study examines metaphor selection for the same abstract concept when multiple concrete dimensions are available for use. Drawing on the power concept, four studies investigated the roles of attention and visual features of concrete dimensions in metaphoric mapping. In Studies 1 and 2, two concrete dimensions (vertical space and size) were visually connected to power-related target words simultaneously, and one was salient. Attention driven by stimulus saliency allowed the attended concrete dimension to have a higher activation level and to be used. In Studies 3 and 4, the attended and the non-attended concrete dimensions were presented separately, and the latter was visually associated with power-related target words. This time, the attended dimension did not have an activation advantage, allowing the non-attended dimension to be used for metaphoric mapping simultaneously. The findings suggest that attention is important but not necessary, and that features of concrete dimensions can guide metaphor use.

Keywords: power, conceptual metaphor, multiple metaphor, metaphor flexibility, attention

Abstract concepts such as time, morality and power are often understood in terms of conceptual metaphors with the help of concrete concepts grounded in our sensory-motor experiences (Lakoff & Johnson, 1980, 1999). For instance, to represent time, people use spatial metaphors involving the front-back or right-left axis (Boroditsky, 2000; Santiago, Lupianez, Perez, & Funes, 2007). To represent social power, they employ metaphors involving vertical space or physical size (Schubert, 2005; Schubert, Waldzus, & Giessner, 2009). However, relatively little is known about uses of metaphors for the same abstract concept when multiple concrete dimensions are available simultaneously. This article addresses this issue. Using the concept of social power, it examines the roles of attention and properties of concrete dimensions in the metaphoric mapping of the same abstract concept. Here, properties of concrete dimensions refer to whether the concrete dimensions are bound as the concrete features of targets representing an abstract concept (e.g., being incorporated as the vertical position or font size of target words representing the abstract concept of power).

The processing of an abstract concept is typically facilitated when people process a metaphorically consistent concrete dimension and inhibited when they process a metaphorically inconsistent concrete dimension (known as metaphor or conceptual congruency effects; Landau, Meier & Keefer, 2010). For example, Meier and Robinson (2004) showed that judgments of positive targets were quicker when they appeared at the top (vs. bottom) of a computer screen, whereas judgments of negative targets were quicker when they appeared at the bottom (vs. top) of the screen. Initially,

metaphor congruency effects were interpreted as the results of well-learned, fixed associations between the meanings of abstract concepts and concrete dimensions (e.g., Boroditsky, 2000; Lakoff & Johnson, 1980, 1999). For example, repeated exposure to powerful actors with larger than average sizes can contribute to the formation of a size metaphor of power. However, this solid foundations view (e.g., Lakoff & Johnson, 1980, 1999) cannot explain the flexibility of metaphor use across different situations, individuals and cultures (Casasanto, 2017; Casasanto & Bottini, 2014; Santiago, Roman, & Ouellet, 2011).

To address this issue, the Coherent Working Models (CWM) theory (Santiago et al., 2011) proposes that abstract concepts are metaphorically bound to different concrete concepts in long-term memory and that activations of abstract and concrete dimensions in working memory are essential for metaphor use. They enable a coherent and global representation that facilitates the handling of the task at hand (see also Spatola et al., 2018). When processing an abstract concept, activation levels of available concrete dimensions determine their inclusion in the representation of the current situation and their ability to interact with the abstract concept. In this conception, attention plays a critical role in metaphor selection.

In the present research, we investigate the extent to which attended and less attended concrete dimensions can guide metaphor selection in a flexible manner. We argue that when multiple concrete dimensions are present and one is attended, the ease of activation of less attended dimensions can also influence metaphor selection. Specifically, when multiple concrete dimensions are present and bound as (irrelevant)

perceptual features of task-relevant stimuli representing an abstract concept, for instance, when power-related target words incorporate concrete dimensions of vertical location and physical size, attention to one of these concrete dimensions increases its activation level, resulting in that the attended dimension has a higher activation level than other less attended dimensions. This can trigger the use of a metaphor linked to the attended dimension. However, when the attended dimension is not bound to task-relevant stimuli and a less attended dimension is connected to task-relevant stimuli as part of its perceptual features (e.g., being target words' position or size), the attended dimension may no longer have priority, and both attended and less attended concrete dimensions may drive metaphor use.

The Role of Attention in the Flexible Use of Metaphors

Past research has examined the role of attention in the context of a single concrete dimension (e.g., Lebois, Wilsen-Mendenhall, & Barsalou, 2015) and the role of top-down attention triggered by task demands or expectations in the context of multiple concrete dimensions (Torralbo, Santiago, & Lupianez, 2006). These studies converged to show that attention drives flexible metaphor use, leading one metaphor to be preferred over others at a given time (Santiago et al., 2011).

When one concrete dimension (e.g., vertical dimension) is afforded at a time, attention can increase the activation level of the concrete dimension and consequently facilitate the use of the corresponding metaphor (Lebois et al., 2015; Santiago et al., 2011). For example, a series of studies on the vertical metaphor of affective valence (Santiago, Ouellet, Roman, & Valenzuela, 2012) demonstrated that valence judgments

of target words were influenced by their vertical positions when attention was directed to the vertical dimension, either in a bottom-up (Study 1, captured by the salient vertical locations of words) or top-down manner (Study 3, focusing on the vertical dimension derived from task instructions). However, when attention was not oriented to the vertical dimension, the “positive/negative-high/low” metaphor congruency effect disappeared (Study 2). Similarly, attention can facilitate the mapping of valence concepts into horizontal space (de la Vega, de Filippis, Lachmair, Dudschig, & Kaup, 2012).

When several concrete dimensions are available at the same time, top-down attention driven by explicit task demands can also influence the relative activation of concrete dimensions and consequently drive metaphor selection. Direct support for this claim has been obtained for temporal metaphors. Torralbo et al. (2006) presented their participants with two orthogonal spatial frames (front-behind and left-right) simultaneously. Attention driven by task requirements determined which spatial frame was primarily used to represent time concepts referring to past and future.

In the present research, we examine the role of bottom-up attention driven by stimulus saliency in the presence of multiple concrete dimensions. Saliency occurs when a stimulus (e.g., a specific concrete dimension) stands out from its surroundings and captures attention because of its noticeable perceptual features (Tsakanikos, 2004). Here, we consider the roles of attention and properties of concrete dimensions that affect their relative activation levels.

Can a Less Attended Concrete Dimension be Used?

In spite of evidence showing that attention can drive metaphor use, it remains unknown whether attention is necessary for metaphor use and whether less attended dimensions can be used for metaphoric mapping. Emerging research has indicated that multiple, non-attended concrete dimensions can be used simultaneously to represent the same abstract domain. Vicario et al. (2008) initially examined the co-activation of two metaphors for temporal duration. Their research showed that duration judgments of stimuli's presence were both affected by the numerical quantity of stimuli and their horizontal locations. Specifically, the authors found metaphor congruency effects – short/long durations-small/large numbers and short/long durations-left/right space – concurrently (see also Dormal & Pesenti, 2013). In addition, past research also found a simultaneous use of front-back and left-right metaphors for time and a combined activation of horizontal and vertical metaphors for quantity (Walker & Cooperrider, 2016; Winter, Perlman, & Matlock, 2013). In these studies, multiple concrete dimensions were afforded simultaneously in connection to the target abstract domain. No cues explicitly or implicitly drew participants' attention to these dimensions. Findings such as these suggest that concrete dimensions that are outside of focal attention can nevertheless be available for use.

Other studies on object-based attention have demonstrated that attention to one aspect of an object automatically promotes the processing of other aspects of the same object, including those that are task-irrelevant (Drummond & Shomstein, 2010; Egly, Driver, & Rafal, 1994; Goldsmith & Yeari, 2003). Of relevance to this point, in the

field of conceptual metaphors, when targets representing abstract concepts incorporated a concrete dimension as their perceptual feature (e.g., power-related words presented in different font sizes; Schubert et al., 2009), this task-irrelevant concrete dimension was active. It metaphorically interacted with the abstract domain during target judgments related to the abstract concepts (see Landau et al., 2010, for a review). This suggests that a less attended concrete dimension bound to stimuli representing an abstract dimension may be used for metaphoric mapping.

Drawing on this evidence, we propose that attention is not necessary and that metaphor selection is more flexible than previously proposed. We argue that attended and less attended dimensions can both guide metaphor use. Specifically, we hypothesize that attention to a concrete dimension can have an advantage in metaphor selection if it has a sustained high level of activation that gives it priority in working memory, relative to less attended dimensions. Several factors can contribute to the ease of processing of attended and less attended dimensions. An example occurs when an attended dimension is bound to task-relevant abstract targets as part of their perceptual features; for instance, during word categorizations, a salient dimension of location or size is associated with target words. However, if the attended dimension is not target-bound and is more difficult to process, its ability to map the abstract construct may be weakened, giving rise to the influence of less attended dimensions (for instance, less attended dimensions that are associated with task-relevant targets) for metaphor selection. Under these circumstances, both attended and less attended dimensions could drive metaphor selection.

Metaphors of Power onto Vertical Space and Physical Size

Social power refers to the potential ability of an individual or group to influence others or control others' outcomes (see Guinote, 2017, for a review). High power is often linked to vertical position and represented as “up” while low power is represented “down” (e.g., Schubert, 2005; Zanolie et al., 2012), for example, “looking up to someone”. Research has shown that the vertical dimension affects power perceptions even when it is irrelevant to the task. For example, through a series of studies, Schubert (2005) found that identifications of powerful words were made more quickly and accurately when presented at the top (vs. bottom) of a computer screen or when associated with upward (vs. downward) responses; the reverse was found to be true for powerless words. Similarly, in marketing contexts, consumers preferred powerful and powerless brands when their logos appeared at the top or close to the base of packaging, respectively (Sundar & Noseworthy, 2014). In addition, perceptions of individuals' power were influenced by their height or the length of a task-irrelevant vertical line (Blaker et al., 2013; Giessner & Schubert, 2007).

A second metaphor relates power to physical size with high power being associated with large sizes (e.g., “the big boss”) and low power being associated with small sizes (e.g., Schubert et al., 2009; Yap, Mason, & Ames, 2013). Schubert et al. (2009) observed a size-power congruency effect: powerful and powerless words were identified more quickly and accurately when they appeared in large and small font sizes, respectively (see also He, Chen, Zhang, & Li, 2015).

Metaphors that employ height and size to connote power have so far been

investigated separately. In this article, we examine contexts in which the two concrete dimensions – vertical space and size – are both available for metaphor use.

Overview of the Current Research

Studies 1 and 2 investigated the role of the saliency of a concrete dimension in the selection of power metaphors when two concrete dimensions (verticality and size) were available and bound to task-relevant stimuli. The studies used a stroop-like paradigm adapted from previous research (e.g., Santiago et al., 2012; Schubert, 2005; Schubert et al., 2009). Target words related to powerful or powerless groups were written in either a large or small font, and were randomly presented in a high or low position of a computer screen. Thus, the two concrete dimensions were bound to the target words. Notably, one dimension (vertical position in Study 1 and word size in Study 2) was more salient than the other. Participants were asked to discriminate the power of the target words as quickly and accurately as possible. We hypothesized that the salient (attended) dimension would have priority, facilitating reliance on the corresponding metaphor.

Studies 3 and 4 explored conditions for the use of less attended concrete dimensions. These studies adopted a cueing paradigm to drive attention to a cued dimension (vertical position in Study 3 and size in Study 4) at first, and then presented a second and less attended dimension (size in Study 3 and vertical position in Study 4) in association with power-related words. Participants were invited to categorize the words. Here, the attended dimension was not bound to the target words whereas the less attended (and task-irrelevant) dimension was a perceptual feature of the words.

This might decrease the activation level of the attended dimension and its priority for use in judgments of the words, which in turn might allow the less attended, target-bound concrete dimension to be processed and used for the metaphoric mapping of power. We therefore hypothesized that both the attended and non-attended dimensions could be used for metaphoric mapping.

In summary, across all studies, attention was triggered in a bottom-up manner to one dimension. However, while in Studies 1 and 2 the two concrete dimensions were features of the target words, in Studies 3 and 4 the attended and less attended dimensions appeared separately and only the less attended dimension was a perceptual feature of the target words. This approach should facilitate the activation of the less attended dimension, making it accessible for concept mapping.

Study 1

Study 1 examined the role of attention when two concrete dimensions were bound to task-relevant words with one (the vertical position) being more salient. Participants were presented with target words referring to powerful (e.g., employer) or powerless (e.g., employee) actors and were instructed to classify the power of the targets. The procedure was analogous to Santiago et al.'s (2012) with one exception: two simultaneous metaphoric cues were presented: vertical word position (words appeared either in a high or low position of a computer screen) and font size (either in a large or small font). Notably, in order to make the vertical dimension more salient than the size dimension, successive strings of crosses approaching the word's position were shown before the word appeared. This manipulation of attention has successfully

been used in past research (Huang & Tse, 2015; Meier & Robinson, 2004; Santiago et al., 2012). Thus, the study employed a 2 (word type: powerful vs. powerless) \times 2 (vertical position: high vs. low) \times 2 (font size: large vs. small) within-participants design. We hypothesized that the attended (salient) dimension of vertical position and not the unattended dimension of font size would be used to represent power, facilitating responses.

Method

Participants. G*Power 3.1 indicated that a sample size of 30 participants was desired. This would make a 2 \times 2 \times 2 within-participant design able to detect a moderate effect size ($f = .25$) at an adequate power level (80%). Thirty-one¹ Chinese-speaking students (12 males and 19 females; mean age = 19.6 years, $SD = 1.7$) took part in this study in exchange for ¥15 or course credit. All participants reported having normal or corrected-to-normal vision.

Materials. Forty-four Chinese words were used. Half denoted powerful groups (e.g., manager) and the other half denoted powerless groups (e.g., subordinate). All words were similar in word length. A pilot pretest showed that the powerful groups ($M = 7.47$, $SD = .62$) were rated (on a scale ranging from 1 to 9) as more powerful than the powerless groups ($M = 3.03$, $SD = .79$), $F_{(1, 40)} = 575.12$, $p < .001$, $\eta_p^2 = .94$. Four of the words were used in a practice block and the remaining words were used in

¹ As the present four studies all employed a 2 \times 2 \times 2 within-participant design, in anticipation of drop-out, non-compliance and errors in task completion, we thus set a priori sample size of 30–40 participants for each study. For each study, we recruited participants for one week, which led to slight variations in the actual numbers of participants of the four studies.

the experimental block.

Procedure. Participants were tested individually in cubicles. They were informed that the study was concerned with individuals' discrimination of powerful and powerless groups. Half of the participants were asked to press the F key on the keyboard for words related to powerful groups and to press the J key on the keyboard for words related to powerless groups. The other half of the participants completed the task with the converse assignment of response keys.

The experiment was conducted on a computer running the E-Prime 2.0 program with a 14-inch screen (resolution: 1,366 pixels \times 768 pixels). Target words were presented centered either at Pixel 20 (high) or 748 (low) on the screen and randomly appeared in a large (48-point) or small (24-point) font (black text on a white background). Each word was randomly shown four times in each of the two vertical positions combined with each of the two font sizes, resulting in 16 trials for the practice block and 160 trials for the experimental block.

Each trial started with the presentation of a central fixation cross for 300 ms. Following the fixation, two strings of crosses (“++++”) progressively appeared towards the location of the target word. The first string was shown at one-third of the distance to the word's position for 300 ms and was followed by the second string, which was also shown for 300 ms at two-thirds of the distance to the word's position. The presence of successive strings of crosses was designed to render the vertical dimension salient. Subsequently, a target word incorporating both vertical and size dimensions was presented and remained on the screen until a response was detected

or 2,500 ms had elapsed. In the practice block, “correct”, “incorrect”, or “no response detected” appeared for 1,000 ms as response feedback after each trial. For the experimental trials, no feedback was given (Figure 1).

Results

Response Latency. Inaccurate trials (4.7% of the trials) were removed.

Response times three standard deviations below or above the grand latency mean were also removed (1.9% of correct trials). A linear mixed model (LMM) was performed to measure the effects of word type (powerful vs. powerless), vertical position (high vs. low) and font size (large vs. small) on response latency (Spatola et al., 2018). The analysis was conducted using the lmerTest package for R (Kuznetsova, Brockhoff, & Christensen 2016; R Core Team, 2017). The tested model included word type, vertical position and font size as fixed effects factors, participants and items as random effects factors, and the by-participant random slopes for word type. Specifically, the tested model was: Latency \sim word type * vertical position * font size + (1+word type|participant) + (1|item)².

The main effect of word type was significant, $b = 53.83$, $t_{(98)} = 3.67$, $p < .001$, 95% CI [25.03, 82.63], indicating that powerful words were identified faster than powerless words. The main effect of vertical position was also significant, $b = 40.32$, $t_{(4535)} = 4.67$, $p < .001$, 95% CI [23.40, 57.24], demonstrating that words shown high on the screen were responded to faster than words shown low on the screen. As

² We compared the tested model to other models including the random slopes for all three experimental factors that varied over participants or items. Those models did not account significantly for more variance.

expected, the interaction between word type and vertical position was significant, $b = -53.09$, $t_{(4537)} = -4.32$, $p < .001$, 95% CI $[-77.16, -29.01]$ (Figure 2). Simple effect analyses showed that powerful words were judged faster when they appeared in a high position compared to a low position, $b = -34.90$, $t_{(4536)} = -5.69$, $p < .001$, 95% CI $[-46.93, -22.90]$. Whereas powerless words were judged faster when they appeared in a low position compared to a high position, $b = 14.80$, $t_{(4538)} = 2.39$, $p = .017$, 95% CI $[2.66, 26.90]$.

In contrast, the main effect of font size, $b = 6.53$, $t_{(4536)} = .75$, $p = .452$, 95% CI $[-10.48, 23.54]$, and the interaction between word type and font size, $b = -13.53$, $t_{(4537)} = -1.09$, $p = .274$, 95% CI $[-37.76, 10.71]$, were not significant. Neither the interaction between vertical position and font size, $b = -10.83$, $t_{(4536)} = -.88$, $p = .377$, 95% CI $[-34.87, 13.21]$, nor the three-way interaction, $b = 6.77$, $t_{(4537)} = .39$, $p = .698$, 95% CI $[-27.39, 40.93]$, were significant.

Accuracy. Participants' accuracy was .95 on average ($SD = .03$). The analysis of response accuracy was conducted using lme4 package for R (Bates, Machler, Bolker, & Walker, 2016; R Core Team, 2017). A generalized linear mixed model (GLMM) assuming a binomial distribution was performed. The model included word type, vertical position and font size as fixed effects factors and items as the random effect factor. Specifically, the tested model was: Accuracy \sim word type * vertical position * font size + (1|item)³.

³ We computed a model including participants and items as random effects factors and the by-participant random slopes for word type and a model with only participants and items as random effects factors. However, the two models failed to converge. We also compared the tested

The main effect of word type was significant, $b = -.87$, $z = -2.37$, $p = .018$, 95% CI [-1.62, -.15], revealing that powerful words were identified more accurately than powerless words. The main effect of font size was marginally significant, $b = -.54$, $z = -1.80$, $p = .071$, 95% CI [-1.17, .05], indicating that categorizations of words presented in a large font tended to be more accurate than words presented in a small font. The main effect of vertical position was not significant, $b = -.06$, $z = -.17$, $p = .864$, 95% CI [-.73, .61].

Neither of the interactions were significant: word type \times vertical position, $b = .35$, $z = .83$, $p = .406$, 95% CI [-.48, 1.18], word type \times font size, $b = .54$, $z = 1.41$, $p = .158$, 95% CI [-.22, 1.32], vertical position \times font size, $b = .02$, $z = .05$, $p = .960$, 95% CI [-.82, .87], and the three-way interaction, $b = .02$, $z = .04$, $p = .971$, 95% CI [-1.09, 1.13].

Discussion

Consistent with our hypotheses, the saliency of the vertical position led to faster discriminations of power-related words presented in congruent positions, whereas font size had no significant effects. This result is consistent with the notion that attention plays a role in mental representations of power, leading to the use of the metaphor that is supported by attention. Furthermore, our results are consistent with previous studies showing that power is associated with the vertical dimension (Schubert, 2005). Even though size has been associated with power in single concrete dimension contexts

GLMM to the model only including participants as the random effect factor. The tested model showed a better model fit than the model.

(Schubert et al., 2009), here, when size was less salient and less attended than verticality, it did not facilitate responses to power-related concepts. We conclude that when multiple concrete dimensions are present simultaneously and are bound to the abstract dimension as perceptual features, an attended dimension is preferred for metaphoric mapping.

Study 2

To ensure that the results of Study 1 did not derive from a stronger association between power and the vertical dimension than the size dimension, in Study 2, we manipulated the saliency of the size dimension. This was achieved by presenting size cues prior to word presentation. The procedure was similar to that of Study 1 with one difference: font sizes (rather than vertical locations) of the target words were cued in advance. We hypothesized that the classification of power-related words would be affected by the font sizes of the words rather than by the words' positions, exhibiting the size-power congruency effect.

Method

Participants. Thirty Chinese-speaking students (14 males and 16 females) with an average age of 19.6 years ($SD = 1.8$) participated in the study in exchange for ¥15 or course credits. All had normal or corrected-to-normal vision.

Materials and procedure. Participants categorized the same words used in Study 1. The procedure was analogous to that of Study 1 with exception of the cues used. In each trial, two strings of crosses (“++++”) preceded the target word simultaneously, with one string appearing high on the screen and the other appearing

low on the screen. They progressively appeared in either larger (large font size condition) or smaller (small font size condition) sizes, with each size shown for 300 ms. This manipulation was designed to render the size dimension (and not the vertical dimension) salient and attract participants' attention. When the size of the two strings turned into the same size as the font in which the target word was written, one of the strings was randomly replaced by the target word (Figure 3).

Results

Response Latency. Inaccurate trials (4.1% of the trials) were removed. Trials with response latencies three standard deviations below or above the grand latency mean were also removed (2.2% of correct trials). In this study, the same tested LMM as that of Study 1 was performed to assess the effects of word type (powerful vs. powerless), vertical position (high vs. low) and font size (large vs. small) on response latency.

The main effect of word type was significant, $b = 51.20$, $t_{(92)} = 2.99$, $p = .004$, 95% CI [17.58, 84.81], indicating that powerful words were identified faster than powerless words. The main effect of font size was also significant, $b = 31.79$, $t_{(4400)} = 3.11$, $p = .002$, 95% CI [11.78, 51.78], revealing that judgments of words presented in a large font were facilitated compared to words presented in a small font. Importantly, as hypothesized, the interaction between word type and font size was significant, $b = -29.38$, $t_{(4400)} = -2.02$, $p = .043$, 95% CI [-57.81, -.95] (Figure 4). Simple effect analyses indicated that powerful words were responded to faster when they appeared in a large font compared to a small font, $b = -40.62$, $t_{(4400)} = -5.62$, $p < .001$, 95% CI

[-54.80, -26.40]. However, responses to powerless words were not significantly affected by font size, $b = -1.69$, $t_{(4401)} = -.23$, $p = .816$, 95% CI [-16.00, 12.60].

In contrast, the main effect of vertical position, $b = 9.77$, $t_{(4400)} = .96$, $p = .338$, 95% CI [-10.19, 29.73], and the interaction between word type and vertical position, $b = .22$, $t_{(4401)} = .02$, $p = .988$, 95% CI [-28.21, 28.67], were not significant. Other effects were also not significant: vertical position \times font size, $b = 17.66$, $t_{(4401)} = 1.22$, $p = .222$, 95% CI [-10.66, 46.00], and the three-way interaction, $b = -19.09$, $t_{(4401)} = -.93$, $p = .352$, 95% CI [-59.29, 21.10].

Accuracy. On average, participants' accuracy was .96 ($SD = .02$). The same tested GLMM as that of Study 1 was performed.

The main effect of word type was significant, $b = -1.01$, $z = -2.61$, $p = .009$, 95% CI [-1.82, -.26], showing that powerful words were responded to more accurately than powerless words. The main effect of font size was significant, $b = -.73$, $z = -2.13$, $p = .033$, 95% CI [-1.44, -.06], indicating that categorizations of words presented in a large font were less accurate than those of words presented in a small font. The main effect of vertical position was significant, $b = -.73$, $z = -2.13$, $p = .033$, 95% CI [-1.44, -.06], revealing that categorizations of words shown high on the screen were more accurate than those of words shown low on the screen.

Consistent with our hypotheses, the interaction between word type and font size was significant, $b = 1.11$, $z = 2.54$, $p = .011$, 95% CI [.25, 2.01]. Simple effect analyses showed that responses to powerful words tended to be more accurate when they appeared in a large font compared to a small font, $b = .39$, $z = 1.74$, $p = .082$, 95%

CI [-.05, .82]. In contrast, responses to powerless words were more accurate when they appeared in a small font compared to a large font, $b = -.44$, $z = -2.17$, $p = .030$, 95% CI [-.85, -.04]. Unexpectedly, the interaction between word type and vertical position was significant, $b = .87$, $z = 2.02$, $p = .043$, 95% CI [.02, 1.74]. Simple effect analyses indicated that responses to powerful words tended to be more accurate when they appeared in a high position compared to a low position, $b = .39$, $z = 1.74$, $p = .082$, 95% CI [-.05, .82]. Whereas responses to powerless words did not differ regardless of their positions, $b = -.20$, $z = -.97$, $p = .334$, 95% CI [-.60, .20]. None of the other interactions were significant: font size \times vertical position font size, $b = .69$, $z = 1.56$, $p = .119$, 95% CI [-.18, 1.59], and the three-way interaction, $b = -.57$, $z = -.95$, $p = .344$, 95% CI [-1.78, .63].

Joint Analyses for Studies 1 and 2

Joint analyses were conducted to examine whether the differences between the results of Study 1 and those of Study 2 were statistically supported⁴. Specifically, data from Studies 1 and 2 were pooled together and submitted to two 2 (study: 1 vs. 2) \times 2 (word type: powerful vs. powerless) \times 2 (vertical position: high vs. low) \times 2 (font size: large vs. small) omnibus ANOVAs for response latency and accuracy respectively. As the two studies had similar sample sizes, this approach is comparable to a meta-analysis of raw mean differences (Bond, Wiitala, & Richard, 2003; Santiago & Laken, 2015).

⁴ Joint analyses for Studies 1 and 2 using LMMs are not reported because the models did not converge. Therefore, we employed a different analytical approach using ANOVAs. We also conducted separate analyses for Studies 1 and 2 using ANOVAs. The full results of these analyses and the joint analyses based on ANOVAs are available at the website: <https://osf.io/x98e5/>

Relevant to our research purposes, the joint analysis of response latency revealed a significant three-way interaction between word type, vertical position and study, $F_{(1, 59)} = 4.37, p = .041, \eta_p^2 = .07$, suggesting that the two-way interaction between word type and vertical position varied with study. As reported earlier, separate analyses of Studies 1 and 2 had yielded a significant two-way interaction between word type and vertical position for Study 1 but not for Study 2. The three-way interaction between word type, font size and study approached significance, $F_{(1, 59)} = 3.89, p = .053, \eta_p^2 = .06$. Separate analyses of Studies 1 and 2 had shown that the two-way interaction between word type and font size was only significant for Study 2 but not for Study 1. The joint analysis of accuracy did not find any results relevant to our research purposes.

Discussion

Consistent with our hypotheses, in Study 2 attention to the size dimension generated the predicted size-power congruency effect. Specifically, participants were faster and more accurate in identifying powerful words when the words appeared in a large (vs. small) font. In contrast, judgments of powerless words were facilitated when they appeared in a small (vs. large) font. This mainly occurred for response accuracy and not for response latency. These results suggest that the association between power hierarchy and size could span through the concepts of high power, which are associated with large sizes, and powerlessness, which are associated with small sizes. Unexpectedly, the less attended vertical dimension affected the accuracy of responses. However, only judgments of powerful words tended to be

metaphorically influenced by their positions. This finding suggests that size-power metaphor was more dominant than vertical-power metaphor in Study 2.

Thus, the results of Study 1 were not triggered by a special status of the vertical dimension as a power metaphor. Instead, when two dimensions were available simultaneously, attention to either of them due to its saliency rendered the dimension active and gave it priority in metaphoric mapping. The joint analyses of Studies 1 and 2 also supported this claim, showing that the vertical-power and size-power congruency effects varied with study (which primarily emerged for response latency).

Study 3

The aim of Study 3 was to investigate whether an attended vertical dimension and a less attended size dimension could simultaneously influence judgments of power concepts. We hypothesized that focal attention is not the sole determinant nor is it necessary for metaphor use. Specifically, when differences in activation levels of an attended and a less attended concrete dimension are difficult to maintain (e.g., the attended dimension is not bound to target words in a word categorization task, and the less attended dimension is bound to these words), the less attended concrete dimension can be active and used for metaphoric mapping.

To test the hypothesis, a cueing paradigm was employed. In a typical cueing paradigm, a spatial cue is presented, driving attention to that region of the visual field, and is then followed by a target in the same or a different location. Processing of a target is generally faster when the target appears in the cued position than when it appears in the uncued position (Posner, 1980). Cueing paradigms can be employed to

explore the role of attention in driving metaphor activation. Abstract and concrete dimensions are presented as the cue and target, respectively, where the target is preceded by the cue (Huang, Tse, & Xie, 2017). For instance, Ouellet, Santiago, Funes, and Lupianez (2010) found that temporal words denoting the past/future facilitated spatial attention to the left/right in a metaphor consistent manner. Notably, abstract and concrete dimensions were not presented as a compound stimulus in the cueing paradigm.

Here, we examined whether an attended, not target-bound concrete dimension (verticality) and a less attended, target-bound concrete dimension (size) would jointly influence the processing of an abstract target dimension (power). In a modified version of the cueing paradigm, an arrow pointing up or down served as a spatial cue that preceded the presentation of a target word. Then, the target word varying in font size was always shown in the center of the screen (Figure 5). Participants categorized the word as belonging to a powerful or powerless group. In order to motivate participants to sustain their attention at the cued location and use the vertical dimension to predict the target word's power before its presence (priming of the vertical-power metaphor), in most of the trials (80%), the arrow's direction predicted power in a metaphor consistent manner (an upward pointing arrow was followed by a powerful word; a downward pointing arrow was followed by a powerless word). Subsequently, the size dimension was introduced by varying the font size of the target word. Thus, the study employed a 2 (word type: powerful vs. powerless) \times 2 (vertical cue: high vs. low) \times 2 (font size: large vs. small) design.

We expected a significant interaction between word type and vertical cue, indicating that the attended vertical dimension would affect responses to power-related words in a vertical-power congruent manner. Additionally, there should be a significant interaction between word type and font size, showing that the less attended, target-bound font size should facilitate responses in a size-power congruent manner.

Methods

Participants. Thirty-three Chinese-speaking undergraduates (12 males and 21 females) took part in the study in return for ¥15. Their average age was 21.8 years ($SD = 2.5$).

Materials. Twenty-seven words referring to powerful groups and 27 words referring to powerless groups were used as target items. Arrows pointing up/down served as the cues of the targets' power.

Procedure. Participants individually completed the task presented with E-Prime 2.0 program. They were asked to indicate whether the words that appeared referred to powerful or powerless individuals by pressing the P key on the keyboard for powerful words and pressing the Q key for powerless words. They were also informed that before the display of a target word, a cue (an arrow pointing up or down) would be presented so that they could use it to predict the target's power.

Each trial began with a 500 ms fixation cross at the center of the screen followed by a vertical cue for 500 ms. Then, a target word was presented either in a large (48-point font) or small (24-point font) font at the center of the screen. Participants

were invited to categorize the word's power as accurately and quickly as possible. The word disappeared from the screen after a response or after 3,000 ms had elapsed. This was followed by the next trial⁵.

The experiment consisted of 10 practice trials and 100 experimental trials. In the experimental block, 80 trials were valid trials (e.g., an upward pointing arrow was followed by a powerful word). The remaining 20 trials were invalid (e.g., a downward pointing arrow was followed by a powerful word). Each vertical position was randomly cued 40 times for valid trials and 10 times for invalid trials. Each target word was presented twice: once in a large font and once in a small font. In congruent size trials, the targets' power was congruent with the font size in a metaphor consistent way (e.g., a powerful word appeared in a large font). In incongruent size trials, the targets' power was incongruent with the font size (e.g., a powerful word appeared in a small font) (Figure 5).

Results

Response Latency. Inaccurate trials (5.6% of the trials) and trials in which the response times were three standard deviations below or above the grand latency mean were excluded from the analysis (1.8% of correct trials). An LMM including word type, vertical cue and font size as fixed effects factors, participants and items as random effects factors, and the by-participant random slopes for word type was

⁵ In the practice session, participants received a 500 ms feedback of *INCORRECT/NO RESPONSE DETECTED* after they provided an incorrect answer or did not provide a response, respectively.

performed⁶.

The analysis yielded a significant main effect of word type, $b = 86.09$, $t_{(168)} = 4.22$, $p < .001$, 95% CI [46.23, 126.11], showing that powerful words were identified faster than powerless words. Neither the main effect of vertical cue, $b = 13.52$, $t_{(2644)} = .86$, $p = .390$, 95% CI [-17.58, 44.27], nor the main effect of font size, $b = -1.37$, $t_{(2950)} = -.15$, $p = .881$, 95% CI [-19.26, 16.51], were significant.

The expected two-way interaction between word type and vertical cue was significant, $b = -64.25$, $t_{(2799)} = -2.89$, $p = .004$, 95% CI [-107.81, -19.99] (Figure 6). Simple effect analyses showed that powerful words were responded to faster when they followed a high position cue compared to a low position cue, $b = -35.30$, $t_{(2050)} = -2.88$, $p = .004$, 95% CI [-59.30, -11.30]. Conversely, powerless words were responded to faster when they followed a low position cue compared to a high position cue, $b = 29.60$, $t_{(2862)} = 2.63$, $p = .009$, 95% CI [7.55, 51.60]. As expected, the two-way interaction between word type and font size was significant, $b = -57.77$, $t_{(2946)} = -2.60$, $p = .009$, 95% CI [-101.22, -13.89]. Simple effect analyses indicated that powerful words were responded to faster when they appeared in a large font compared to a small font, $b = -20.40$, $t_{(2952)} = -2.01$, $p = .044$, 95% CI [-40.30, -.53]. Whereas powerless words were responded to faster when they appeared in a small font compared to a large font, $b = 38.00$, $t_{(2946)} = 3.42$, $p < .001$, 95% CI [16.20, 59.82].

While irrelevant to our research purposes, the two-way interaction between vertical

⁶ We also compared the tested model to other models including random slopes for all three experimental factors that varied over participants or items. The models did not have an improved model fit.

cue and font size was also significant, $b = 43.56$, $t_{(2750)} = 2.15$, $p = .032$, 95% CI [3.83, 83.25]. Simple effects analyses showed that words following a high position cue were identified faster when they appeared in a small font compared to a large font, $b = 30.30$, $t_{(2947)} = 2.72$, $p = .007$, 95% CI [8.43, 52.10]. However, responses to words following a low position cue were not significantly affected by font size, $b = -12.70$, $t_{(2952)} = -1.25$, $p = .212$, 95% CI [-32.52, 7.20]. The three-way interaction between word type, vertical cue, and font size was not significant, $b = -1.27$, $t_{(2990)} = -.04$, $p = .966$, 95% CI [-60.49, 57.51].

Accuracy. The average accuracy rate of participants was .94 ($SD = .03$). A GLMM assuming a binomial distribution was performed. The model included word type, vertical cue and font size as fixed effects factors and participants as the random effect factor. Specifically, the tested model was: Accuracy \sim word type * vertical cue * font size + (1|participant)⁷.

The main effect of word type was significant, $b = -.99$, $z = -3.16$, $p = .002$, 95% CI [-1.60, -.36], showing that powerful words were identified more accurately than powerless words. The main effect of font size was significant, $b = -.49$, $z = -2.03$, $p = .042$, 95% CI [-.98, -.02], indicating that words presented in a large font were categorized more accurately than words presented in a small font. The main effect of vertical cue was not significant, $b = .20$, $z = .44$, $p = .663$, 95% CI [-.63, 1.20].

⁷ We ran the models including participants and items as random effects factors and the by-participant random slopes for word type, including participants and items as random effects factors, and only including items as the random effect factor. However, the three models failed to converge.

Neither of the interactions were significant: word type \times vertical cue, $b = .76$, $z = 1.37$, $p = .170$, 95% CI [-.40, 1.80]; word type \times font size, $b = .63$, $z = 1.43$, $p = .152$, 95% CI [-.23, 1.50]; vertical cue \times font size, $b = -.15$, $z = -.26$, $p = .793$, 95% CI [-1.33, .96], and the three-way interaction, $b = .09$, $z = .12$, $p = .902$, 95% CI [-1.34, 1.56].

Discussion

The results of Study 3 indicate that vertical space and size information jointly influenced power judgments. In this study, the attended vertical dimension was presented as a separate cue before the abstract target, and it drove the use of vertical-power metaphor. This result is consistent with previous studies showing that metaphor activation could occur when concrete and abstract dimensions were presented separately at different locations in cueing paradigms (Huang et al., 2017). Furthermore, after the presence of the attended vertical dimension, the size dimension appeared as a perceptual feature of the abstract target. The separate presence might cause the vertical dimension to be processed and activated before the size dimension, and weaken its dominance (or activation level) in the presence of the abstract target, allowing the latter presented, target-bound size dimension to trigger a size-power metaphor. Therefore, this finding shows that attention is not necessary for metaphor activation. A less attended, target-bound dimension (size) can be used to represent power-related targets.

Study 4

To ensure that the effects obtained from Study 3 were not dependent on a

specific presence pattern of concrete dimensions (verticality was presented as the cue prior to size), in Study 4 we tested whether the attended, not target-bound concrete physical size and the less attended, target-bound vertical dimension appearing separately would influence the processing of power-related concepts simultaneously.

Study 4 was analogous to study 3 except that the cues varied according to size, and subsequently the vertical position of the target words was manipulated.

Methods

Participants. Thirty-seven Chinese-speaking undergraduates (16 males and 21 females) participated in this study in return for ¥15. Their average age was 21.3 years ($SD = 2.7$).

Materials. The target words were the same as those used in Study 3. The cue was either a large blue (#2A92AD) circle with a diameter of 4.5 cm or a small blue circle with a diameter of 1.7 cm.

Procedure. First, a circle was presented at the center of the screen to serve as a size cue. In half of the trials the cue was large (4.5 cm) and in the other half it was small (1.7 cm). In valid trials (80% of the trials), the size of the circle predicted the power of the target words consistently with a size metaphor (e.g., a large circle was followed by a powerful word). In invalid trials (20% of the trials), the size of the circle contradicted the words' power meaning (e.g., a small circle was followed by a powerful word). Each word was presented twice: once at the top of the screen and once at the bottom of the screen (Figure 7).

Results

Response Latency. Inaccurate trials (5.0% of the trials) were discarded. Outliers (three standard deviations below or above the grand latency mean) were removed (1.8% of correct trials). An LMM including word type, size cue and font size as fixed effects factors, participants and items as random effects factors, and the by-participant random slopes for word type was performed.

There was a significant main effect of word type, $b = 99.23$, $t_{(207)} = 4.39$, $p < .001$, 95% CI [55.10, 143.44], showing that powerful words were identified faster than powerless words. Neither the main effect of size cue, $b = 15.81$, $t_{(3185)} = .88$, $p = .377$, 95% CI [-19.43, 50.80], nor the main effect of vertical position, $b = 7.19$, $t_{(3334)} = .68$, $p = .494$, 95% CI [-13.39, 27.76], were significant.

As expected, the two-way interaction between word type and size cue was significant, $b = -83.13$, $t_{(3174)} = -3.26$, $p = .001$, 95% CI [-133.03, -32.87] (Figure 8). Simple effect analyses indicated that powerful words were responded to faster when they followed a large cue compared to a small cue, $b = -38.00$, $t_{(3060)} = -2.95$, $p = .003$, 95% CI [-63.30, -12.70]. In contrast, powerless words were responded to faster when they followed a small cue compared to a large cue, $b = 39.60$, $t_{(3056)} = 3.06$, $p = .002$, 95% CI [14.20, 65.00]. The two-way interaction between word type and vertical position was also significant, $b = -85.00$, $t_{(3254)} = -3.34$, $p < .001$, 95% CI [-134.80, -34.88]. Simple effect analyses showed that powerful words were responded to faster when they appeared in a high position compared to a low position, $b = -29.40$, $t_{(3294)} = -2.32$, $p = .020$, 95% CI [-54.20, -4.57]. Whereas powerless words were responded to faster when they appeared in a low position compared to a high position, $b = 50.10$,

$t_{(3263)} = 3.93, p < .001, 95\% \text{ CI } [25.10, 75.14]$. While irrelevant to our research interests, the two-way interaction between size cue and vertical position was marginal, $b = 44.44, t_{(3289)} = 1.76, p = .079, 95\% \text{ CI } [-5.11, 94.03]$. Simple effect analyses demonstrated that words following a large cue were categorized faster when they appeared in a low position compared to a high position, $b = 35.30, t_{(3257)} = 2.77, p = .006, 95\% \text{ CI } [10.30, 60.30]$. However, responses to words following a small cue were not significantly affected by vertical position, $b = -14.60, t_{(3294)} = -1.15, p = .250, 95\% \text{ CI } [-39.50, 10.30]$. The three-way interaction between word type, size cue, and vertical position was not significant, $b = 10.95, t_{(3269)} = .30, p = .761, 95\% \text{ CI } [-59.68, 81.24]$.

Accuracy. The average accuracy rate of participants was .95 ($SD = .03$). A GLMM assuming a binomial distribution was performed. The model included word type, size cue and vertical position as fixed effects factors and participants as the random effect factor⁸.

The main effect of word type was significant, $b = -1.54, z = -4.75, p < .001, 95\% \text{ CI } [-2.18, -.90]$, showing that judgments of powerful words were more accurate than those of powerless words. The main effect of size cue was significant, $b = -1.23, z = -3.57, p < .001, 95\% \text{ CI } [-1.91, .54]$, indicating that judgments of words following a large cue were more accurate than those of words following a small cue. The main

⁸ Similar to Study 3, we ran alternative models: models including participants and items as random effects factors and the by-participant random slopes for word type, including participants and items as random effects factors, and only including items as the random effect factor. However, the three models failed to converge.

effect of vertical position was not significant, $b = -.14$, $z = -.47$, $p = .640$, 95% CI [-.76, .46].

The interaction between word type and size cue was significant, $b = 2.19$, $z = 4.86$, $p < .001$, 95% CI [1.29, 3.07]. Simple effect analyses showed that powerful words were identified more accurately when they followed a large cue compared to a small cue, $b = 1.34$, $z = 5.77$, $p < .001$, 95% CI [.89, 1.80]. Conversely, powerless words were identified more accurately when they followed a small cue compared to a large cue, $b = -1.07$, $z = -5.14$, $p < .001$, 95% CI [-1.48, -.66]. None of the other interactions were significant: word type \times vertical position, $b = .14$, $z = .32$, $p = .748$, 95% CI [-.74, 1.04], size cue \times vertical position, $b = -.21$, $z = -.46$, $p = .644$, 95% CI [-1.14, .70], and the three-way interaction, $b = .45$, $z = .72$, $p = .473$, 95% CI [-.78, 1.68].

Joint Analyses for Studies 3 and 4

Similar to Studies 1 and 2, data from Studies 3 and 4 were pooled together and submitted to two 2 (study: 3 vs. 4) \times 2 (word type: powerful vs. powerless) \times 2 (vertical information: high vs. low) \times 2 (size information: large vs. small) omnibus ANOVAs for response latency and accuracy respectively⁹.

Relevant to our research purposes, the joint analysis of response latency demonstrated that the two-way interaction between word type and vertical

⁹ Joint analyses using LMMs yielded non-convergent models. Thus, ANOVAs were performed. We also carried out separate analyses for Studies 3 and 4 using ANOVAs. The full results of these analyses and the joint analyses based on ANOVAs are available at the website: <https://osf.io/x98e5/>

information was significant, $F_{(1, 68)} = 19.87, p < .001, \eta_p^2 = .23$, and was not qualified by the three-way interaction between word type, vertical information and study, $F_{(1, 68)} = 1.91, p = .171, \eta_p^2 = .03$. In addition, the two-way interaction between word type and size information was significant, $F_{(1, 68)} = 17.53, p < .001, \eta_p^2 = .21$, and was not qualified by the three-way interaction between word type, size information and study, $F_{(1, 68)} = 1.29, p = .259, \eta_p^2 = .02$.

The joint analysis of accuracy showed that the two-way interaction between word type and vertical information was significant, $F_{(1, 68)} = 5.01, p = .029, \eta_p^2 = .07$, and was not qualified by the three interaction between word type, vertical information and study, $F_{(1, 68)} = .81, p = .372, \eta_p^2 = .01$. The two-way interaction between word type and size information was significant, $F_{(1, 68)} = 18.47, p < .001, \eta_p^2 = .22$. Moreover, this two-way interaction was qualified by the three-way interaction between word type, size information and study, $F_{(1, 68)} = 6.76, p = .011, \eta_p^2 = .09$. Separate analyses of Studies 3 and 4 had revealed that the size-power congruency effect of response accuracy only emerged in Study 4. No other results relevant to our research purposes were found.

Discussion

Study 4 showed that the categorization of power-related words was influenced by size cues and the vertical space dimension, demonstrating “powerful/powerless-large/small” and “powerful/powerless-high/low” metaphor congruency effects simultaneously. These effects primarily occurred at the response latency level. The results are consistent with our hypothesis that attended and less

attended dimensions can jointly facilitate the processing of power-related targets. Specifically, attention drove the activation of size-power metaphor. However, the separate presence of the attended size dimension and power-related targets decreased the ease of processing of the size dimension in judgments of abstract targets. Thus, the size dimension did not have an activation level advantage for entering the mapping of power concepts. This gave the less attended vertical dimension, which was bound to power-related targets as their locations, a chance to be used to represent the abstract targets.

Furthermore, the joint analyses of the pooled response latency of Studies 3 and 4 confirmed that the vertical-power and size-power congruency effects simultaneously emerged in both studies. The results suggest that both power metaphors were active and used. There was some inconsistency between the separate analyses of Studies 3 and 4 and the joint analysis of accuracy. For example, separate analyses did not yield a significant two-way interaction between power and vertical information while the joint analysis did so. This might be due to the fact that separate analyses using GLMMs controlled for individual differences as random effects, while the joint analysis based on ANOVA used participants' average accuracy. Besides, previous research showed that metaphor congruency effects emerged for response latency prevalently. However, the results of accuracy were not consistent (Schubert, 2005). Some studies yielded metaphor congruent effects on accuracy (e.g., Spatola et al., 2018; Torralbo et al., 2006) while others did not (e.g., Lebois et al., 2015; Santiago et al., 2012).

In summary, the results show that focal attention is not necessary for metaphor

use. When an attended and a less attended concrete dimension are present separately and only the latter is bound to the abstract concept, the attended dimension will not have an activation advantage compared to the less attended dimension. This time, the less attended dimension can also be used for metaphoric mapping.

General Discussion

Conceptual metaphors are tools used to comprehend and represent abstract concepts in terms of concrete dimensions (Landau et al., 2010; Landau, Robinson, & Meier, 2014). The present research investigated metaphor use in the presence of multiple concrete dimensions. We hypothesized that attention and features of concrete dimensions can drive metaphor use. Focal attention to a relevant concrete dimension can facilitate metaphor use but is not necessary. Specifically, when multiple concrete dimensions are simultaneously present in association to the abstract concept, attention triggered by stimulus saliency can drive metaphor selection, leading the most active concrete dimension to be used for metaphoric mapping of the abstract concept. However, when an attended concrete dimension is separately present at a different location than target stimuli representing the abstract concept, and a less attended dimension is a feature of the stimuli, the saliency of the former may decrease during the processing of the abstract stimuli. Under these conditions, the attended dimension may lose priority for metaphoric mapping, and the less attended concrete dimension may be used to map the abstract concept.

These hypotheses were examined in the context of power metaphors. Studies 1 and 2 showed that when more than one concrete dimensions are available and one is

more salient, attention to this dimension will activate the corresponding metaphor. Specifically, vertical and size dimensions were simultaneously available during the presence of power-related target words. In Study 1, when vertical space was salient, a vertical-power metaphor congruency effect emerged, with the vertical position but not size influencing the processing of power-related targets. Conversely, when size was salient in Study 2, a size-power metaphor congruency effect emerged. This time size rather than vertical position influenced the processing of the power concept.

In Studies 3 and 4, a concrete dimension was conveyed by a cue (vertical cue in Study 3 and size cue in Study 4) at first. The cue captured attention to the respective dimension. Subsequently, a second concrete dimension was shown at a different location together with a power-related target word. Under these conditions, the saliency and activation level of the attended dimension decreased during the processing of power-related words. Therefore, its advantage for metaphoric mapping is weakened, allowing the less attended, target-bound concrete dimension to map power simultaneously.

Together, these findings contribute to a nuanced understanding of the roles of attention and features of concrete information in multiple metaphor use. They support the notion that conceptual metaphors are used flexibly depending on contexts. Not only attention but also features of concrete displays (e.g., presence patterns) can affect the relative activation of attended and less attended dimensions. This in turn can guide metaphoric representations. The present research contributes to the growing evidence showing malleability of concept processing, and how attention and context influence

its processing (e.g., de la Vega et al., 2012; Lebois et al., 2015; Torralbo et al., 2006).

The present research highlights also the role of bottom-up processes underlying metaphor selection within a flexible framework. We show how bottom-up processes (saliency in Studies 1 and 2; presence pattern of concrete dimensions in Studies 3 and 4) can impact metaphor use when multiple concrete dimensions are available. We believe that a similar influence of attended and less attended dimensions on metaphor selection can be found when attention is driven in a top-down manner, for instance, through goals, such as task instructions. This possibility needs to be investigated in future.

Although previous research has examined two power metaphors separately (e.g., Schubert, 2005; Schubert et al., 2009), none of the studies focused on them concurrently. Here, we show that either one of the power metaphors can be interchangeably used, depending on attention and features of the concrete dimensions. Specifically, the location and binding of concrete (task-irrelevant) dimensions to task-relevant stimuli (words) can influence the relative activation of the multiple concrete dimensions. These processes seem all to play a role in metaphor use in a nuanced manner. In summary, the findings reveal how bottom-up processes enforced by properties of attended and less attended dimensions present in the visual field can flexibly influence metaphor selection.

Implications of the Present Research

The findings are consistent with aspects of the CWM theory on metaphor selection (Santiago et al., 2011; Spatola et al., 2018), but advance this perspective in

important ways. Concerning the role of attention, the current research shows that not only concrete dimensions under focal attention but also less attended dimensions can guide metaphor use. When an attended concrete dimension is at a different location than target words, and a less attended dimension is a perceptual feature of the words (vertical location or physical size), the latter can attain a sufficient level of activation and impact metaphor selection. This finding is consistent with previous research, which has shown that task-irrelevant perceptual aspects of objects can be automatically processed (e.g., Drummond & Shomstein, 2010; Landau et al., 2010; Meier, Fetterman, & Robinson, 2015). The results show a preference of the cognitive system for effortless and fast processing during metaphoric mapping. Attention driven in a bottom-up manner and features of displays affect the relative activation level of concrete dimensions and impact responses. This suggests that metaphor selection follows an easy processing principle.

Furthermore, as discussed above, the current findings demonstrate a great deal of flexibility in metaphor use. They testify against the notion that abstract concepts are metaphorically grounded in concrete information in a universal and consistent manner (e.g., Lakoff & Johnson, 1980, 1999). Focusing on multifaceted and dynamic contexts, here we propose and show new conditions for flexible use of metaphors that do not necessarily require focal attention. Exogenous conditions that affect the ease of maintaining focal attention and inhibiting non-attended information seem to play a role on how concrete dimensions are incorporated in metaphoric mapping.

The studies have also implications for the understanding of power-related

metaphors. Previous research has only investigated different power metaphors (size and vertical space) separately (e.g., Schubert, 2005; Schubert et al., 2009). Our work is the first to investigate the processing of the power concept when vertical and size dimensions are both available. It shows that in some contexts only one of the two metaphors is dominant, while in other contexts both metaphors are ready to be used simultaneously.

Limitations and Future Research

In the current Studies 3 and 4, we kept the less attended concrete dimension binding to the abstract targets while the location of the attended dimension shifted. However, other variations in the location of attended and less attended stimuli are possible. This would inform about processes and the primary cause of simultaneous activations of attended and less attended dimensions. Are simultaneous activations due to decreased activation of the attended dimension (by being separately located in relation to the abstract concept)? Are they triggered by increased activation of the less attended dimension (by being the sole dimension bound as a perceptual feature of the abstract concept)? or both? More work is needed to further examine underlying processes.

The design of Studies 3 and 4 enables us to observe independent activations of multiple metaphors for the same abstract concept. However, according to the CWM theory (Spatola et al., 2018), if metaphors are activated in working memory during the task of processing the abstract concept at hand, multiple metaphors for the same abstract concept will compete. Therefore, each metaphor may modulate the

processing of the other, and metaphor congruency effects will thus interact. Future studies may investigate the process difference and its underlying mechanism.

The present work only examined a particular condition when attended and less attended concrete dimensions can be simultaneously used for metaphoric mapping of a given abstract concept. Given that the CWM theory proposes that metaphor use depends on concrete and abstract dimensions being activated in working memory and their coherence interactions (Santiago et al., 2011), further research could explore other conditions for the use of multiple metaphors and their cognitive processes.

Conclusions

The present work suggests that when multiple concrete dimensions related to different metaphors of the same abstract concept are available simultaneously, attention driven by stimulus saliency and cueing can facilitate metaphor selection. Specifically, when multiple concrete dimensions are simultaneously present with target stimuli representing an abstract domain, attention driven by saliency drives metaphor selection, allowing the most active concrete dimension to be used to map the abstract concept. However, when an attended and a less attended concrete dimensions are separately present at different locations and only the less attended dimension is associated with abstract targets, the priority of the attended dimension for metaphoric mapping is weakened and both of the dimensions can be used to represent the abstract concept simultaneously. We conclude that metaphor use in the context of multiple concrete dimensions is flexible and that both attention and features of concrete dimensions can guide it.

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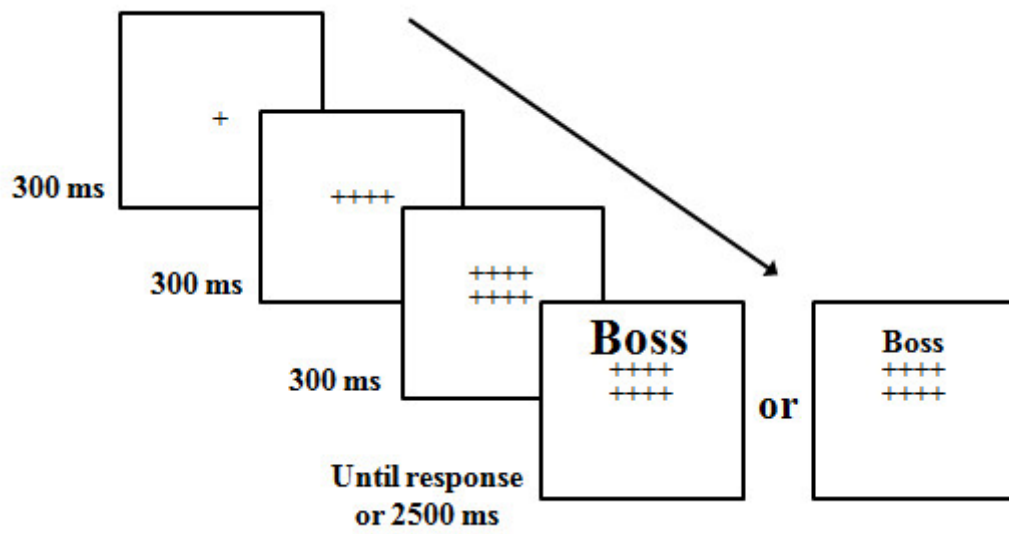


Figure 1. Sequence of events for trials with a powerful word presented in a high position of the screen (Study 1).

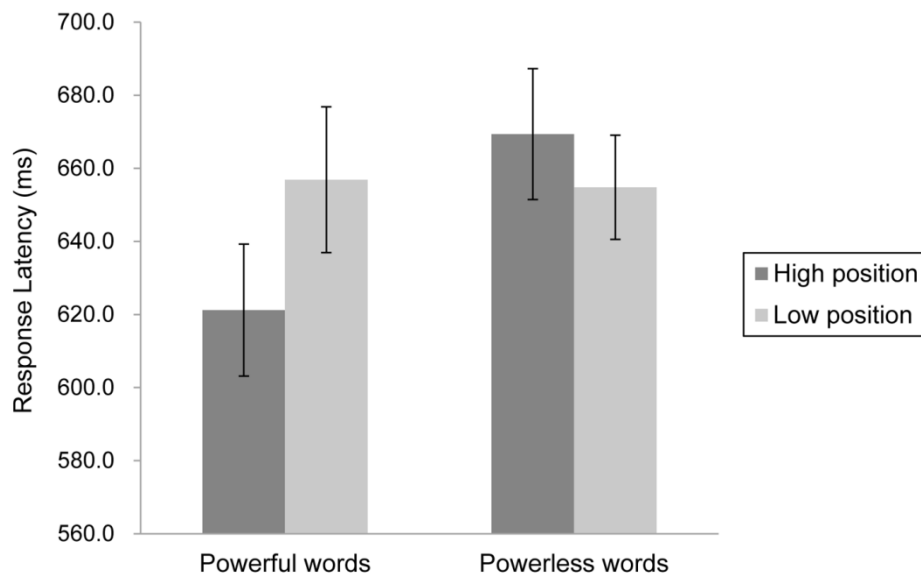


Figure 2. Distribution of response latency (in ms) data per condition in Study 1, as a function of word type (powerful vs. powerless) and vertical position (high vs. low).

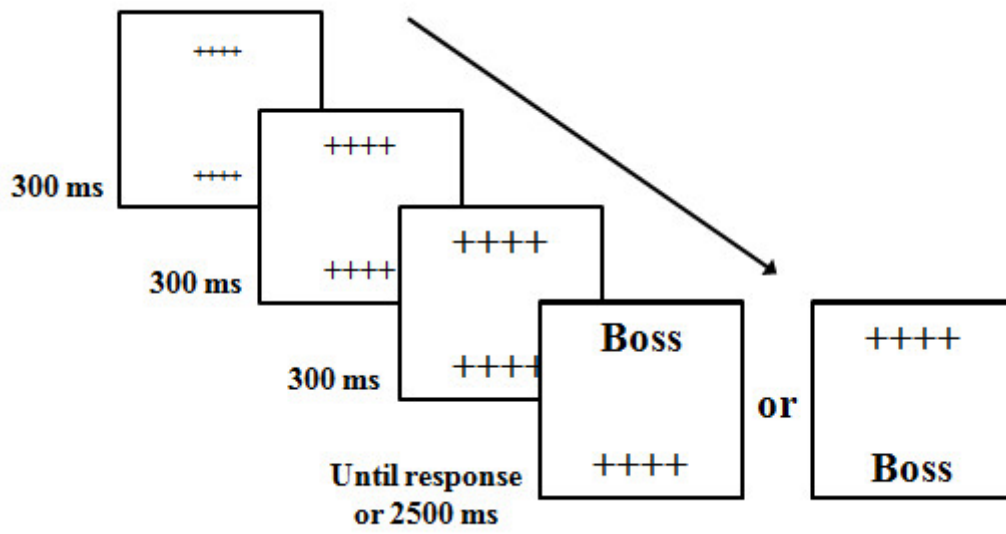


Figure 3. Sequence of events for trials with a powerful word presented in a large font (Study 2).

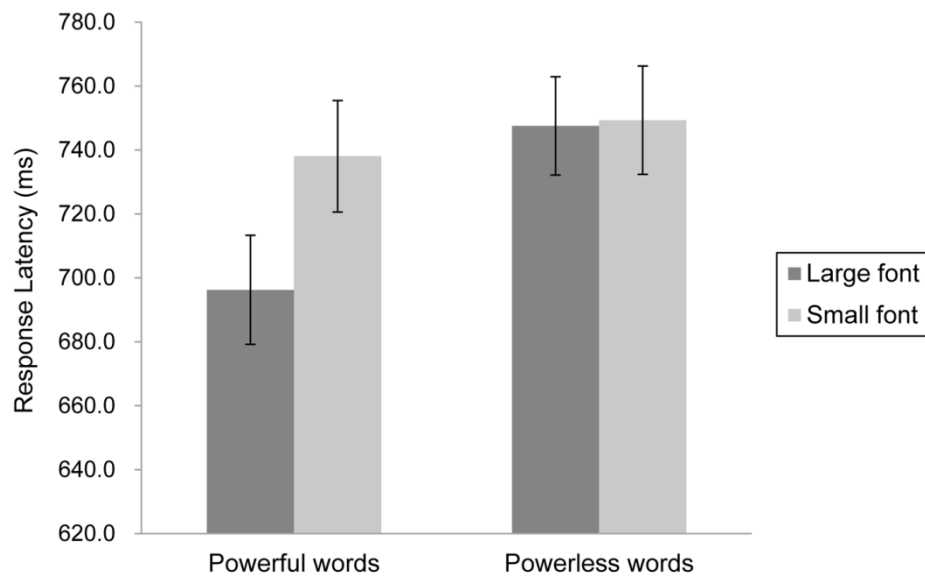


Figure 4. Distribution of response latency (in ms) data per condition in Study 2, as a function of word type (powerful vs. powerless) and font size (large vs. small).

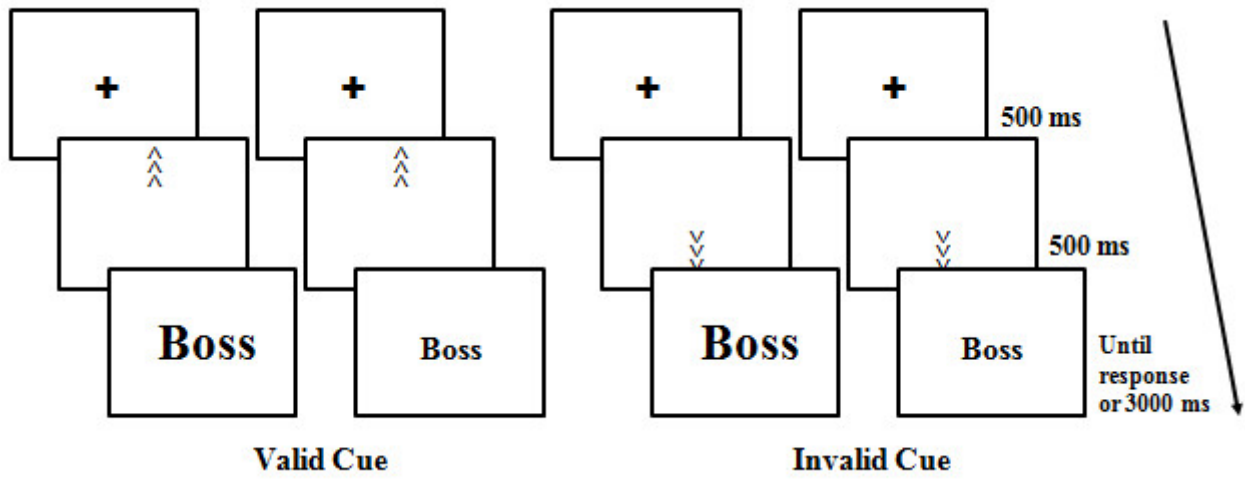


Figure 5. Sequence of events for trials of a powerful word (Study 3).

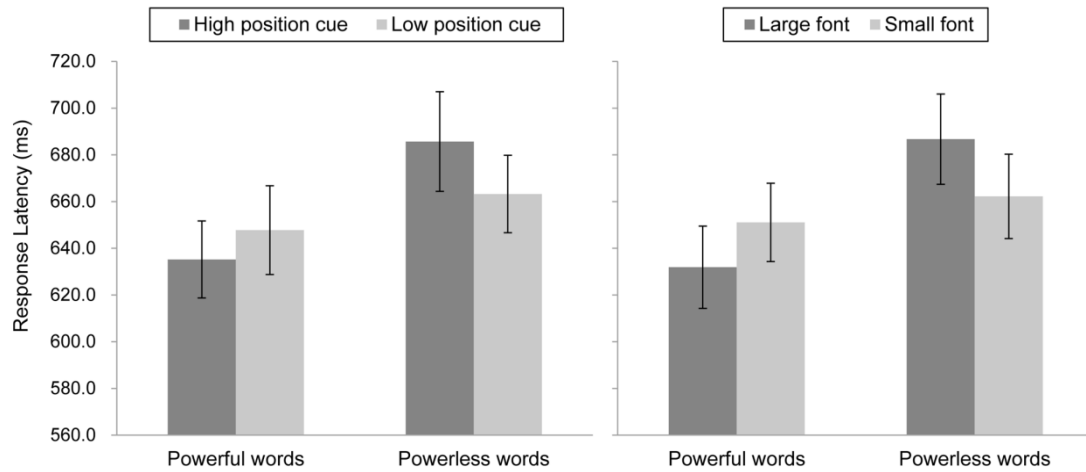


Figure 6. Distribution of response latency (in ms) data per condition in Study 3, as a function of word type (powerful vs. powerless) and vertical cue (high vs. low) and a function of word type (powerful vs. powerless) and font size (large vs. small).

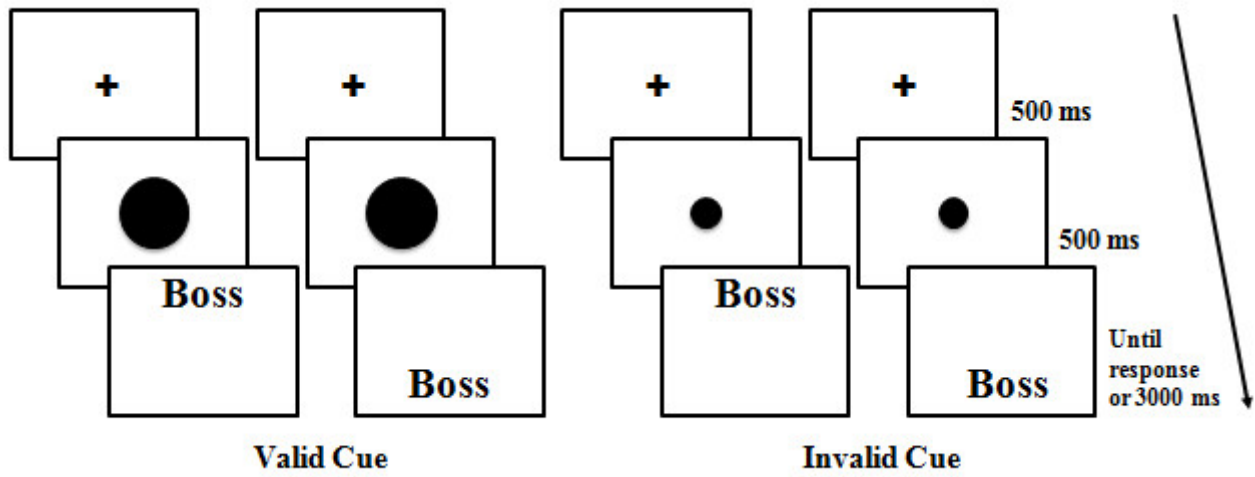


Figure 7. Sequence of events for trials of a powerful word (Study 4).

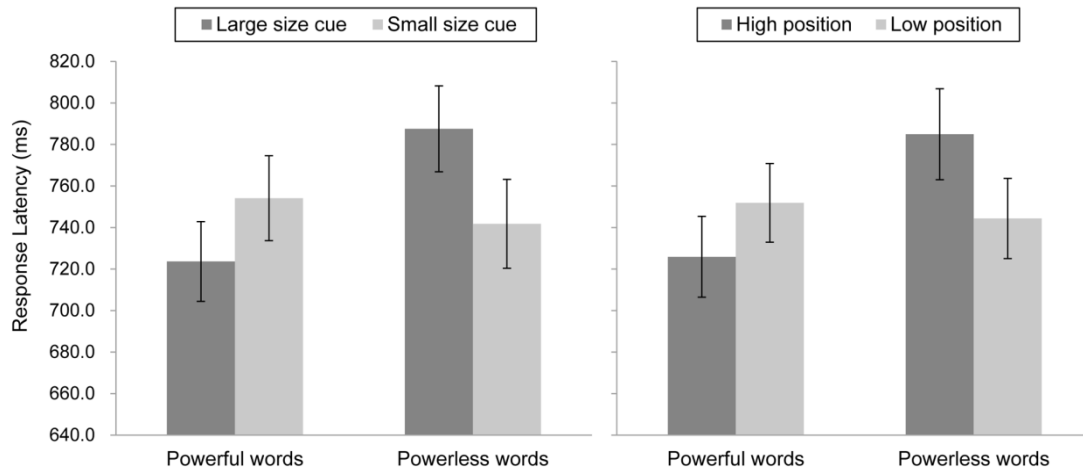


Figure 8. Distribution of response latency (in ms) data per condition in Study 4, as a function of word type (powerful vs. powerless) and size cue (large vs. small) and a function of word type (powerful vs. powerless) and vertical position (high vs. low).