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Verbal-spatial and visuospatial coding of power–space interactions

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ABSTRACT

A power-space interaction, which denotes the phenomenon that people responded faster to powerful words when they are placed higher in a visual field and faster to powerless words when they are placed lower in a visual field, has been repeatedly found. The dominant explanation of this power-space interaction is that it results from a tight correspondence between the representation of power and visual space (i.e., a visuospatial coding account). In the present study, we demonstrated that the interaction between power and space could be also based on a verbal-spatial coding in absence of any vertical spatial information. Additionally, the verbal-spatial coding was dominant in driving the power-space interaction when verbal space was contrasted with the visual space.

1. Introduction

Ideas about how abstract concepts are mentally represented have received much attention within the domain of cognitive psychology. Of these abstract concepts, power is an important one in the social domain. Power denotes the ability or capacity to influence others through the control of resources, according to psychological literature (Galinsky, Gruenfeld, & Magee, 2003; Keltner, Gruenfeld, & Anderson, 2003). When talking about power in daily life, we often use height information. For example, leaders who supervise their employees have "high" status, or are "up" in the hierarchy. However, the employees are at the "lower" levels of the hierarchy. In a word, power is often metaphorically understood, presented, and communicated nonverbally as vertical height in visual space: "control is up, lack of control is down" (Lakoff & Johnson, 1980; Lakoff, 1987).

1.1. Modal representation of power

This idea is broadly in line with the perceptual symbol systems theory (Barsalou, 1999, 2008; cf. Glenberg, 1997). It argues that conceptual thinking involves perceptual simulation. Representing abstract concepts reactivates previously stored information from sensory-motor experience to form a simulation of this sensory-motor experience. Supporting this analogue, much evidence suggest interactions between sensory-motor experience and power (Chiao et al., 2009; Chiao, 2010; Giessner & Schubert, 2007; Jiang and Zhu, 2015; Jiang, Sun, & Zhu, 2015; Lu, Schubert, & Zhu, 2017; Mason, Magee, & Fiske, 2014; Schubert, 2005; von Hecker, Klauer, & Sankaran, 2013; Zanolie et al., 2012). For example, Schubert (2005) found that power judgments were affected by spatial information in the vertical dimensions provided by vision. In one of his experiments, participants were presented with pairs of group labels (e.g., employer-employee, master-servant), one at the top and the other at the bottom of the screen, and were required to judge which label was powerful. Participants reacted faster when powerful group labels appeared at top and powerless group labels appeared at the bottom. In other experiments, single words referring to powerful or powerless groups were presented. Participants decided whether

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the word represented a powerful or powerless group. The stimulus position (either at the top or at the bottom of the computer screen) or response key (up or down cursor keys) was manipulated. Interactions between stimulus position or response key and power were found, i.e. participants responded faster to powerful groups when they appeared at the top of the screen and to powerless groups when they appeared at the bottom of the screen, and they responded faster to powerful groups with the up cursor key and to powerless groups with down cursor key.

Our work (Jiang et al., 2015) found that such interactions also appeared during tasks without an explicit power evaluation. Participants were presented words denoting people and words denoting animals (e.g., powerful animal: tiger; powerless animal: cat) in the experiment. The task was to determine whether an animal or a human label was presented, with no explicit power evaluation. The height information was again whether pressing an up or down cursor key press. The findings showed that participants responded faster to words representing powerful groups with the up cursor key and to words representing powerless groups with the down cursor key.

The dominant explanation for such power-space interactions is that they result from a tight correspondence between the representation of power and visual space (a visuospatial coding account). That is, different levels of power are presented as different vertical heights. Another observation that is regarded as strong evidence for a tight correspondence between the representation of power and visual space is the distance effect. A distance effect has been found in the judgment of many abstract concepts that were represented as a continuous space, such as numbers or status. Such an effect indicates that the amount of time it takes to compare two items of a concept is an inverse function of how much numerical distance separates those items. For example, people responded more slowly when they compare numbers that are closer in quantity (e.g., 98 vs. 99) relative to those farther in quantity (e.g., 11 vs. 99, Dehaene, Piazza, Pinel, & Cohen, 2003; Moyer & Landauer, 1967). Similarly, the response time to compare two power words was an inverse function of the power distance between them (Jiang and Zhu, 2015).

1.2. Amodal representation of power

However, the visuospatial nature of power representation is challenged by common theories. Barsalou's (1999) perceptual symbol systems theory argues that all conceptual knowledge is based on modal representations. However, this approach stands at odds with common notions of semantic networks, where concepts are represented as quasi-verbal nodes and activation spreads through these nodes. Schubert (2005) claimed that such amodal representation could explain power-space interactions. Specifically, the node "powerful" links to the node "high" and the node "powerless" links to the node "low". The perception of a power word at the top of the screen activates the node "high". The activation spreads to the node "powerful" through their link, which facilitates the responses for powerful words. Similarly, Proctor and Cho (2006) claimed that polarity correspondence was sufficient to produce the stimulus-response mapping effects. The two opposite concepts of a category are represented as positive or negative components. For example, they proposed that the observed spatial-numerical association of response codes effect (SNARC) effect (i.e., small numbers are responded faster by left keys and large numbers are responded faster by right keys) was due to the reason that both "small" and "left" were represented as negative whereas "large" and "right" were represented as positive. According to their view, power-space interactions might not only result from a high-to-low continuous power space, but also from a polarity correspondence between verbal concepts "powerful" and "high" (positive) and "powerless" and "low" (negative).

This contrast between modal and amodal representation is broadly in line with Paivio's (1986) dual coding theory. According to the dual coding theory, objects are coded both in an analogue and in a verbal-symbolic system. For the analogue, the object is represented as an image with size and color, etc. In the verbal-symbolic system, the object is represented as a verbal label. In a similar vein, Gevers, Santens, Dhooge, and Chen (2010) argued that the visuospatial (i.e., modal) and verbal-spatial (i.e., amodal) codes both exist. Their study found that the SNARC effect resulted not only from the mental-number line, but also from the connections between numbers (small–large) and verbal-spatial labels (left–right).

1.3. The current research

Given that objects and numbers can be represented in both codes (e.g., Lupker, 1979; Rosinski, 1977), it is possible that a power concept can also be represented in both codes. We suspected that the power-space interactions could be based on both visuospatial and verbal-spatial codes. As for visuospatial coding, the power judgments would be affected by the congruency between the power of a stimulus and the spatial position associated with its response. On the other hand, if it is verbal-spatial coding, the power judgments would be affected by the congruency between the word's power and verbal label ("high" or "low") of each response.

Referring to Gevers et al. (2010), we examined both coding of power-space associations by four experiments. In Experiment 1, in order to demonstrate the verbal-spatial coding, we investigated whether power judgments would be swayed by the meaning of verbal labels. In Experiment 2, like several previous studies (Jiang and Zhu, 2015; Jiang et al., 2015; Lu et al., 2017; Schubert, 2005), we tried to demonstrate visuospatial coding. In Experiment 3 and 4, we tried to compare the two coding systems by setting in a power judgment and a semantic categorizing (Jiang et al., 2015) task, respectively.

2. Experiment 1

In previous studies, power judgments are affected by spatial information in the vertical dimensions provided visually, either in stimulus positions (Schubert, 2005) or using response keys (Jiang et al., 2015; Lu et al., 2017). In the present experiment, we tested the effect of verbal response label ("high" or "low") on power judgments in absence of any height information from the visual space.