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Fast track report

Grounding person memory in space: Does spatial anchoring of behaviors improve recall?

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Abstract

In two experiments, we examine and find support for the general hypothesis that memory for behavioral information in the context of an impression formation task depends on where that information is located in vertical space. These findings extend earlier work showing that memory for location and shifts of spatial attention are influenced by the "good is up" metaphor. Specifically, we show that person memory is better for behavioral information in metaphor compatible locations (positive in upper space and negative in lower space) than in metaphor incompatible locations (positive in lower space and negative in upper space). These findings show for the first time that person-specific information, and person memory in general, is structured spatially. Copyright © 2011 John Wiley & Sons, Ltd.

The impressions we form of others constitute important markers guiding the way we navigate our social world. Not surprisingly, the subject of impression formation has occupied center stage in social psychology from its early beginnings (Allport & Allport, 1921; Anderson, 1965; Asch, 1946; Hamilton, Katz, & Leirer, 1980a; Hastie, Ostrom, Ebbesen, Wyer, Hamilton, & Carlston, 1980; Srull, 1981). A focus on the nature of the mental representations underlying how we think about persons and analyses of the processes driving such thinking shaped the course of the field, leading to the development of increasingly sophisticated bodies of theory about the nature of mental representations, their impact on judgments, and the nature of variables affecting information processing (e.g., Wyer & Srull, 1989; for reviews see Smith, 1998; Wyer & Carlston, 1994). In this view, person cognition became the construction and manipulation of inner representations, with the implicit assumption that knowledge about persons is dissociated from any sensory base and thus amodal (e.g., Wyer & Srull, 1989). However, cognition is constrained by the properties of our evolved brains and bodies (Semin & Smith, 2002, 2008; Smith & Semin, 2004). Adopting an embodied view of person cognition casts this field in the *active context* of navigating the social world suggesting that like other cognitive processes, impressions are structured by the incorporation of sensorimotor and affective elements.

The current research was designed to investigate the general hypothesis that valenced behavioral information acquired in the course of our daily social interaction can be anchored spatially. These experiments extend earlier work (cf. for a review Crawford, 2009) that has demonstrated that memory for location and shifts of spatial attention are influenced by the ''good is up'' metaphor, and that memory is better for valenced stimuli that appear in metaphor-compatible locations (positive in upper space and negative in lower space) than those that appear in metaphor-incompatible locations (positive in lower space and negative in upper space). We will do so by exploring for the first time the ''good is up'' metaphor in a standard person memory paradigm. Specifically, we examined in two experiments if memory for behavioral information about a target person depends on where such information is placed in vertical space. Thus, the novel contribution of the two experiments is to show for the first time that a vertical spatial structure underlies person memory and anchors specific behaviors and their recall.

In the following, we first present the standard person memory view and its shortcomings. We then outline an approach to person memory designed to address these shortcomings.

PERSON MEMORY: THE STANDARD VIEW AND ITS SHORTCOMINGS

The delivered view of how we organize our perceptions of others, namely person memory, relies on a representational approach imported from cognitive psychology (e.g., Anderson & Bower, 1973; Collins & Loftus, 1975; Collins & Quillian,

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1969). Accordingly, our knowledge of persons is represented in memory by means of abstract nodes interconnected to each other in a network of semantic knowledge. These nodes are assumed to be amodal, namely they do not retain sensory and motor qualities of the perceived stimuli. Consequently, impressions were viewed as amodal memory structures measured with variables designed to assess inferences about the ''perceiver's organized cognitive representation of another person'' (Hamilton, Katz, & Leirer, 1980b, pp. 123) from memory. However, criticisms made about amodal semantic network models (e.g., Barsalou, 1999; Harnad, 1990) can also be leveled at information processing models of person memory.

An alternative view of person memory arises from recent theorizing and research from an embodied cognition perspective (e.g., Barsalou, 1999, 2008; Glenberg, 2008; Wilson, 2002; Zwaan, 2004), namely that cognition is grounded by sensorimotor and affective neural systems. Research supportive of this general perspective is accumulating (cf. Barsalou, 2008; Semin & Smith, 2008). In particular, there is considerable research underlining the close link between specific types of linguistic stimuli and sensorimotor activation. Reading action words or sentences with action words recruits neural activity in cortical motor areas that are activated when the corresponding action is executed (e.g., Buccino, Riggio, Melli, Binkofski, Gallese, & Rizzolatti, 2005; Pulvermüller, Shtyrov, & Ilmoniemi, 2005; Tettamanti et al., 2005). Similarly, sentences referring to actions (e.g., moving your hand toward/away from the body) interact with the performance of these actions (e.g., Glenberg & Kaschak, 2002; Zwaan & Taylor, 2006).

However, the hotly debated question that is at the heart of embodied approaches to cognition is how we represent, think, and communicate about abstract concepts (e.g., traits) that do not afford immediate sensorimotor experiences (cf. Barsalou, 2008; Boroditsky & Prinz, 2008; Lakoff & Johnson, 1999; Semin & Smith, 2008). One of the solutions is offered by conceptual metaphor theory (e.g., Lakoff & Johnson, 1999), according to which, perceptual experiences such as space or motion serve as the metaphorical source to structure abstract target domains. Accordingly, the structural alignment between a source and a target domain grounds the abstract concept of, for example, affect or valence. Considerable evidence supports this contention in the affect area (see Crawford, 2009, for a review). For instance, in an early contribution, Meier and Robinson (2004) showed that positive words such as *ethical or friendly* are classified more rapidly as positive when they were presented at the top rather than at the bottom of a monitor, with the reverse holding for negative words.

While there is no research examining the interface between vertical spatial dimension and impression formation, there is a spate of research on spatial memory of positive and negative images. For instance, Crawford, Margolies, Drake, and Murphy (2006), after presenting participants with positive and negative images on the upper or lower half of a monitor, asked them to recall the original position at which the images had been presented. Participants' retrieval revealed that there was an upward position bias for positive images and a downward bias for negative. Recently, Casasanto and Dijkstra (2010) have reported that participants were faster in retrieving positive autobiographical memories when performing upward movements and negative memories when performing downward movements.

Notably, the extant research supporting the relation between valence and verticality has relied on discrete stimulus materials that have no interconnected coherence aside from their evaluative loading; and on interference paradigms with response time as the dependent variable (see Crawford, 2009, for a review). Impression formation paradigms, by contrast, typically use rich behavioral descriptions, interconnected in a target person and involve complex integrative processes. Typically, they entail incidental learning tasks and memory measures, such as free recall, an effortful and resource demanding retrieval mode (e.g., Garrido, Garcia-Marques, & Hamilton, 2010). This contrasts strongly with experimental paradigms that have explored the spatial grounding of valenced stimuli.

Furthermore, the current extension to impression formation goes beyond replicating previous research on the spatial grounding of valence. By examining how the spatial presentation of information shapes impressions of target persons or groups, this research opens a window for exploring how other sensorimotor variables can affect and constrain impression formation and social judgment, typically regarded as amodal processes.

OVERVIEW

Based on earlier research showing that the vertical dimension serves as a source to ground the abstract target domain of affect or valence, we expected that the recall of behavioral information about a target person would be facilitated when this information is presented in a spatially compatible rather than a spatially incompatible vertical location. Thus, in both experiments the stimulus materials consisted of *behavioral information* about one of two different target persons. The target person was a skinhead in one experimental condition and a childcare professional in the other.

In both experiments, the vertical position of the relevant behavioral information was manipulated. In the first experiment, the information was presented on a large screen. In the second experiment, participants had to put the behavioral descriptions printed on cards on a higher or lower location.

In both cases, participants received a subsequent surprise recall task after having read all the behavior descriptions about the respective target person. The hypothesis under consideration was that participants' recall would be superior for positive and negative target behaviors if the target's positive behaviors were presented/placed in a vertically higher position in space and negative behaviors in a vertically lower position in space rather than the reverse.

EXPERIMENT 1

Experiment 1 was designed to examine if recall of positive and negative behavioral descriptions about two different targets is influenced by where the behaviors are presented on a vertical spatial location. To this end, we adapted a typical impression

formation paradigm (e.g., Hamilton et al., 1980a). Participants were asked to form an impression about the target person who was described sequentially with a number of positive (or negative) behavioral statements. This was followed by a surprise free recall task. According to the hypothesis under examination, memory performance was expected to be enhanced when positive and negative behavioral descriptions were presented respectively at the top or the bottom of a large screen, namely spatial locations compatible with the grounding of valence on a vertical axis.

Methods

Participants and Design

Seventy-nine students (40 female; mean age 21.63) participated in this study on a voluntary basis. The study had a 2 (Target: childcare professional vs. skinhead) × 2 (Type of behavior: stereotype relevant vs. irrelevant) × 2 (Screen location: top vs. bottom) mixed design, with repeated measures on the last two variables.

Stimulus Materials

The stimulus materials consisting of 36 behavioral descriptions were used in both Experiments 1 and 2. They were selected from a larger pool that had been developed and piloted extensively (Garrido, 2003). Twelve of these behaviors were *friendly* behaviors typical of a *childcare professional* (e.g., *He helped an elderly person to use the ATM*) and 12 were *unfriendly* behaviors typical of a *skinhead* (e.g., *He intentionally ignored the phone calls of a friend*). The remaining 12 behaviors were irrelevant and not diagnostic of either stereotype (e.g., *Waited for the bus on that morning*) and were included to make the impression formation task more plausible.

Procedure

Participants, seated at a distance of 1.5 m from a large screen (200 cm × 220 cm) were informed that the experiment was concerned with ''the way people form impressions about others.'' They were also told that they would be presented with behaviors performed by a person and were encouraged to form an overall impression of this person. For half of the participants, the target was the *childcare professional* and for the other half it was the *skinhead*. They were then given some general information about the target person including his name, occupation, and the impression held by people who know him (e.g., *Pedro Rodrigues is a childcare professional. He is very friendly, helpful, and sensitive*).

A total of 24 behaviors were presented for each target consisting of 12 stereotype relevant (i.e., friendly behaviors in the case of the childcare professional and unfriendly in the case of the skinhead) and 12 irrelevant behaviors. Six of each group of behaviors was presented at the top of the screen and 6 at the bottom in a randomized order, each for 8 seconds. The spatial location of the behaviors was counterbalanced across participants. Thus, if a behavior was presented at the top of the screen for one participant then it was presented at the bottom for the next participant.

After completing the impression formation task, participants were given a 5-minute filler task. They were then asked to rate the target on seven 9-point scales measuring perceived *target valence* (sensitive/insensitive; friendly/unfriendly; helpful/not helpful; positive/negative; good/bad; pleasant/unpleasant; likable/unlikeable). Subsequently, they received an unexpected free recall task and had to recall all the behaviors that were presented during the impression formation task. Finally, participants were asked to write down what they thought the hypothesis of the study was. All participants were unaware of the actual hypothesis. They were then debriefed and thanked.

Results and Discussion

A coder blind to the experimental conditions categorized the recall data, using a lenient gist criterion. Recall intrusions were infrequent (<3%) and excluded from all analyses.[1] Overall recall was 5.6 ($SD = 2.8$). In the following, we present separate analyses for stereotype relevant behaviors and irrelevant behaviors, since the latter are not valenced and there is no *a priori* reason to expect them to be systematically affected by their positioning in vertical space.

Expectancy Manipulation Check

To examine the effectiveness of the expectancy manipulation we scaled the responses to the seven items measuring perceived target valence (Cronbach's $\alpha = .97$). As expected, participants judged the childcare professional more positively ($M = 7.48$; $SD = 1.23$) than the skinhead ($M = 2.76$; $SD = 1.11$; $t\ (73) = 17.47$, $p < .001$, $d = 4.01$).

Recall of Relevant Behaviors

The chief prediction was that memory performance is enhanced for positive and negative behavioral descriptions presented respectively at the top or the bottom of a screen compared to the reverse pattern of presentations. To test this, we created a new variable—*compatibility*—by collapsing the expectancy-relevant behaviors recalled as follows: childcare professional's (positive) behaviors presented at the top and skinhead's (negative) behaviors presented at the bottom of the screen constituted the *compatible* condition; childcare professional's (positive) behaviors presented at the bottom with skinhead's (negative) ones presented at the top of the screen constituted the *incompatible* condition. According to our hypothesis recall should be higher for valence/position *compatible* behaviors over valence/position *incompatible* behaviors.

The number of recalled expectancy-relevant items was analyzed in a 2 (Target stereotype: childcare professional vs.

[1]The recall data of four participants were omitted because they did not understand the recall instructions (they inferred traits).

skinhead) × 2 (Compatibility: compatible vs. incompatible) analysis of variance (ANOVA) with repeated measures on the last factor.

As predicted, relevant behaviors presented in compatible locations had a significant recall advantage ($M = 2.05$; $SD = 1.22$) compared to relevant behaviors presented in incompatible locations ($M = 1.61$; $SD = 1.20$; F (1, 73) = 5.44, $p = .022$, $MSE = 7.24$, $\eta_p^2 = .07$. There was no significant interaction between ''Compatibility'' and ''Target'' ($F < 1$), thus meaning that both positive and negative behaviors contributed equally to the reported compatibility effect.

Additionally, there was a significant main effect for the target variable, F (1, 73) = 11.78, $p < .001$, $MSE = 18.97$, $\eta_p^2 = .14$, with *skinhead* behaviors ($M = 2.18$; $SD = 1.26$) being recalled better than *childcare professional* behaviors ($M = 1.47$; $SD = 1.28$). The observed recall advantage for the *skinhead* behaviors (unfriendly behaviors) is consistent with the literature suggesting an advantage for negative stimuli in memory (see Kensinger, 2009, for a review).

Recall of Irrelevant Behaviors

The number of correctly recalled irrelevant behaviors did not yield, as predicted, any systematic effects in a 2 (Target: childcare professional vs. skinhead) × 2 (Screen location: top vs. bottom) ANOVA, with repeated measures on the last factor (all p's $> .16$).

Taken together, these results support our hypothesis that people ground their memory of affectively charged behaviors with reference to a vertical spatial dimension. When valence and vertical spatial dimension are made compatible recall is enhanced compared to conditions where this compatibility is absent. These results show for the first time that previous findings from spatial and autobiographical memory (Casasanto & Dijkstra, 2010; Crawford et al., 2006) extend to person memory, thus opening a new perspective to explore the implications of spatial grounding in a process that has been traditionally regarded as an amodal one.

EXPERIMENT 2

In the second experiment, the vertical dimension was manipulated by means of upward or downward arm-movements—namely an explicit motor component that goes beyond standard vertical spatial manipulations (e.g., Crawford et al., 2006; Meier & Robinson, 2004; however see Casasanto & Dijkstra, 2010). Participants stood in front of an empty bookcase and had to form impressions of a target person on the basis of cards on which the behaviors were printed. They had to place these cards either on a top or a bottom shelf. If people anchor their memory of positive and negative information about others on a vertical spatial dimension, then behaviors placed in compatible shelves, (i.e., positive behaviors in the top shelf and negative behaviors in the bottom shelf) should be better recalled than behaviors placed on incompatible shelves.

Methods

Participants and Design

Fifty-nine students (25 female; mean age 20.88) participated in this experiment on a voluntary basis. The study had a 2 (Target: childcare professional vs. skinhead) × 2 (Type of behavior: relevant vs. irrelevant) × 2 (Shelf: top vs. bottom) mixed design, with repeated measures on the last two variables.

Procedure

The stimulus materials were identical to those in the first experiment. However, now the behavioral items were presented on cards (10 cm × 14 cm) that were put together in a random order as a deck, which was placed on the middle shelf of an empty bookcase consisting of three shelves. The position of the middle shelf was adjusted to shoulder height of each participant. The distance between the shelves was always 42 cm. The participants were informed that this task involved a typical dual task that one encounters in everyday life, namely forming impressions while performing a concurrent task. They then received the target and expectancy information, and were instructed to pick up a card at a time from the middle shelf, read the behavior printed on the card and place it on the top or bottom shelf.

There was an arrow next to each behavior (above or under the sentence) indicating the shelf where each card should be placed. Instructions were pre-recorded and informed participants that they had 8 seconds to pick up a card, read the behavior, and place it on the respective shelf. Then they received a recorded instruction indicating that they had to take the next card. This procedure was repeated until they had read and placed all the cards. Experiment 2 was otherwise identical in every possible respect to Experiment 1 except for the procedure involving the presentation and placement of the cards.

Results and Discussion

A coder blind to the experimental conditions categorized the recalled behaviors using a lenient gist criterion. Recall intrusions were infrequent (<2%) and were excluded from all analyses.[2] Overall recall was 6.15 ($SD = 2.61$).

Expectancy Manipulation Check

Responses to the seven items used to assess perceived target valence were scaled (Cronbach's $\alpha = .95$) with high numbers reflecting higher positivity. As expected, participants judged the childcare professional as more positive ($M = 7.38$; $SD = .95$) than the skinhead ($M = 3.10$; $SD = 1.34$; t (53) = 13.73, $p < .001$, $d = 3.77$).

[2]Data from five participants was omitted because they did not understand the recall instructions.

Recall of Relevant Behaviors

Again, a *compatibility* variable was composed by collapsing the number of compatible items (positive behaviors shelved upward and negative behaviors shelved downward) and *incompatible* items (positive behaviors shelved downward with negative ones shelved upward) into two variables.

The central hypothesis predicting a recall advantage in the compatible over the incompatible condition was analyzed in a 2 (Target: childcare professional vs. skinhead) × 2 (Compatibility: compatible vs. incompatible) ANOVA with repeated measures in the last factor and the number of recalled items as the dependent variable. As predicted, recall was significantly better for behaviors in the compatible condition ($M = 2.43$; $SD = 1.16$) than the incompatible condition ($M = 1.92$; $SD = 1.27$); $F\ (1,\ 53) = 4.40$, $p = .041$, $MSE = 7.13$, $\eta_p^2 = .08$. The interaction term was again not significant ($F < 1$).[3]

Again, a main effect of the "Target" was found, $F\ (1,\ 53) = 26.47$, $p < .001$, $MSE = 35.33$, $\eta_p^2 = .33$. Recall of negative behaviors ($M = 2.74$; $SD = 1.17$) was superior to recall of positive behaviors ($M = 1.61$; $SD = 1.14$) a finding that is consistent with the *negativity effect* (Kensinger, 2009).

Recall of Irrelevant Behaviors

A 2 (Target: childcare professional vs. skinhead) × 2 (Screen location: top vs. bottom) ANOVA, with repeated measures in the last factor, on the number of correctly recalled irrelevant behaviors did not yield any significant effects (all F's < 1).

Overall, these findings are consistent with our hypothesis that anchoring affectively charged information on a spatial vertical dimension influences recall. As predicted, behaviors presented in compatible vertical locations facilitated recall. These findings reproduce the same outcome pattern as obtained in Experiment 1, however now with an experimental paradigm involving a different manipulation namely a spatial placement procedure. These converging results underline the generalizability of our contention that in impression formation processes the recall of stereotype relevant behaviors is grounded spatially.

GENERAL DISCUSSION AND CONCLUSIONS

The two experiments were designed to contribute to the person memory literature with a hypothesis derived from an embodied cognition framework, namely, to examine the effect of how information in different locations on a vertical dimension influences recall. Both experiments yielded confirmatory evidence for our predictions: if the spatial location of behavioral descriptions is congruent with the valence of the behavior then a subsequent surprise recall indicates a significant recall advantage for these behaviors.

To our knowledge, this is the first set of studies examining impression formation and person memory from a grounded cognition perspective demonstrating the significance of the vertical spatial dimension in facilitating recall of a social target's behavioral information. These findings are consistent with and extend the growing body of evidence showing an association between valence and the vertical space (Crawford, 2009), as in the case of research using interference paradigms (e.g., Meier & Robinson, 2004), or measures like autobiographic recollection (Casasanto & Dijkstra, 2010). Previous research investigating the spatial grounding of affect or valence has been done mostly with decontextualized words or images that have no interconnected coherence beyond their valence (cf. Crawford, 2009). The novelty of the research we have reported here is the use of a contextualized standard impression formation paradigm and free recall as dependent measure using a different conceptual tool—embodied cognition theories—that was never been applied to this area. It is the first time that a coherent impression is shown to be affecting recall as a function of the spatial position of behaviors that relate to a person. There is an important implication of these findings for standard representational models of person memory. If it is the case that person memory processes are driven exclusively by amodal symbolic and abstracts representations in a network of items whose accessibility depends on the strength of association between the behavioral item and the target node, then the spatial position in which behavioral information is presented should be irrelevant. Revealing the significance of spatial position for recall highlights the contribution of modal processes for person memory.

Another important question that arises from our results refers to the role of movement in driving the obtained compatibility effects. Although Experiments 1 and 2 involve differences in the magnitude and salience of vertical movements, the means and effect sizes in both experiments were similar thus suggesting that movement is orthogonal to the spatial compatibility memory effect. Therefore, an interesting argument deriving from our research is that the contributions of movement and spatial location on recall are independent. Notably, *overall* recall is higher in Experiment 2, which necessitated an over and explicit arm movement, relative to Experiment 1 which involved an implicit head movement (6.15 vs. 5.6), a finding that appears to be compatible with research on the relationship between actions and memory (Krauss & Hadar, 1999; Nilsson, 2000).

The re-examination of classic issues in social cognition from an embodied perspective opens novel perspectives upon the constraints, such as spatial position, that drive and add to our understanding of the processes involved in person memory. These considerations invite the investigation of how other sensorimotor variables (e.g., bodily posture, environmental features such as temperature) that have been shown to influence judgments can affect the way we navigate our social world from the impressions we form to how we regulate our social relationships.

[3]Although shelf height was individually adapted, we entered participants' height as a covariate in the analysis and found that it had no impact on the results (all F's < 1).

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