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EXPERIENTIAL ORIGINS OF MENTAL METAPHORS: LANGUAGE, CULTURE, AND THE BODY

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People not only talk metaphorically, they also think metaphorically. Where do our mental metaphors come from? Metaphor theorists posit that hundreds of metaphors in language and thought have their basis in bodily interactions with the physical world. Yet the origins of most mental metaphors are difficult to discern because the patterns of linguistic, cultural, and bodily experience that could give rise to them appear mutually inextricable. This chapter highlights three mental metaphors for which the contributions of language, culture, and the body can be distinguished unambiguously. By analyzing the distinct ways in which *politics*, *time*, and *emotional valence* come to be metaphorized in terms of left–right space, it is possible to illustrate the

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distinct linguistic, cultural, and bodily origins of the mental metaphors that scaffold our thoughts, feelings, and choices.

METAPHORS BEYOND LANGUAGE

At one time, the claim that people think metaphorically was supported only by patterns in language (Clark, 1973; Jackendoff, 1983; Lakoff & Johnson, 1980, 1999), but there is now behavioral evidence that source domain representations are activated with a high degree of automaticity when people think about abstract domains including time (Boroditsky, 2000), number (Dehaene, Bossini, & Giraux, 1993), similarity (Casasanto, 2008), emotional attachment (Williams & Bargh, 2008), and power (Schubert, 2005; for a review of more than 40 studies validating metaphor theory, see Landau, Meier, & Keefer, 2010). People think in mental metaphors even when they are not using language (Casasanto & Boroditsky, 2008; Dolscheid, Shayan, Majid, & Casasanto, 2013). That is, when people conceptualize domains such as time, number, or emotion, their conceptualizations may be partly constituted by mental metaphors: implicit, analog mappings between nonlinguistic mental representations in a concrete "source domain" (e.g., space, force, motion) and a relatively abstract or unfamiliar "target domain."[1] Mental metaphors import the relational structure of source domains such as space into target domains, allowing us to envision, measure, and compare the "height" of people's excitement, the "depth" of their sadness, or the "breadth" of their compassion (Boroditsky, 2000; Casasanto, 2009; Lakoff & Johnson, 1999).

In their groundbreaking book, *Metaphors We Live By*, Lakoff and Johnson (1980) wrote: "We do not know very much about the experiential bases of metaphors," noting that "our physical and cultural experience provides many possible bases" (p. 19). Two decades later, however, Lakoff and Johnson (1999) were no longer circumspect about the origins of mental metaphors. They advanced a forcefully argued theory of how hundreds of primary metaphors, the basic building blocks of all mental metaphors, are inevitably acquired on the basis of bodily interactions with the physical environment.

On this proposal, mental metaphors arise due to the unavoidable conflation of two types of bodily experiences: subjective experiences in target domains and perceptuomotor experiences in source domains. For example, the metaphor *affection is warmth* arises in children's minds as a consequence of feeling the physical warmth of their caretakers' bodies as they are held and comforted. The metaphor *time is motion* arises as children subjectively experience the passage of time while watching moving objects travel through space. According to Lakoff and Johnson (1999),

> We do not have a choice as to whether to acquire and use primary metaphor. Just by functioning normally in the world, we automatically and unconsciously acquire and use a vast number of such metaphors. Those metaphors are realized in our brains *physically* and are mostly beyond our control. They are a consequence of the nature of our brains, our bodies, and the world we inhabit. (p. 59, italics in original)

Lakoff and Johnson's (1980) earlier suggestion that at least some basic metaphors could be grounded in cultural experiences was replaced by a monolithic argument for an "embodied" basis for mental metaphors, echoed subsequently by numerous books and papers in the literatures on embodied cognition in linguistics, philosophy, psychology, and cognitive neuroscience (for an overview, see Gibbs, 2006).

REASONS TO QUESTION THE EMBODIED BASIS OF MENTAL METAPHORS

Although Lakoff and Johnson's (1999) proposal has been widely accepted, there are at least four reasons to doubt that conflations between subjective and perceptuomotor experiences, which occur inevitably and universally during the course of early cognitive development, give rise to all (or *any*) of our basic mental metaphors. The first reason for skepticism is a simple lack of evidence. The evidence offered by Lakoff and Johnson (1999) is their interpretation of Christopher Johnson's (1999) survey of a single metaphor in a single child's speech input and output. They suggested that purely metaphoric uses of *to see* meaning *to know* (e.g., "I see what you're saying") were preceded by uses of *see* in which its literal (visual) and metaphoric (epistemic) meanings were conflated (e.g., "let's see [and thereby come to know] what's in the box"). Lakoff and Johnson (1999) suggested that *seeing* and

[1]The term *conceptual metaphor* is often used ambiguously, even by metaphor theorists: Sometimes the term refers to expressions in language, other times to hypothetical nonlinguistic mental representations, and still other times to both linguistic and nonlinguistic mappings. These ambiguities complicate discussions of the relationship between metaphoric language and metaphoric thinking. I distinguish the linguistic and nonlinguistic components of conceptual metaphors by using the term *linguistic metaphor* to refer to words and expressions in language and the term *mental metaphor* to refer to the associations between nonlinguistic source and target domains, which are hypothesized to underlie linguistic metaphors (Casasanto, 2008, 2009). This terminological distinction becomes particularly important when discussing mental metaphors such as the left–right spatial mappings of *time* and of *valence* in left-handers, for which no corresponding linguistic metaphors exist, and discussing linguistic expressions such as *my right hand man* and *the right answer*, which people appear to use without activating any corresponding mental metaphor.

knowing were initially fused in the child's mind due to their conflation in his experiences with vision and knowledge: Seeing things (perceptuomotor source domain) was correlated with knowing about them (subjective target domain), and thus seeing and knowing were "not experienced as separate" (p. 49). Eventually, after this period of conflation and fusion, *seeing* and *knowing* can be differentiated, but a source–target association remains.

Lakoff and Johnson's (1999) interpretation of Christopher Johnson's study appears to be at odds with Johnson's own interpretation: Johnson denied that *seeing* and *knowing* are ever conceptually fused in the child's mind (instead, he simply noted that they are conflated in adults' language).[2] Moreover, the logic by which the linguistic data support Lakoff and Johnson's ontogenetic claim about mental metaphors is elusive. The child used *see* most frequently in its visual senses (Johnson, 1999, Table 1). Yet if the ideas of *seeing* and *knowing* were initially fused, shouldn't *see* have been used indiscriminately, either to refer to acts of seeing or to acts of knowing? There may be a simple explanation for the observed longitudinal pattern in the use of *see*: Children may be able to talk, and think, about concrete acts of perception earlier than they can talk and think about abstract mental states (e.g., Aksu-Koç, Ögel-Balaban, & Alp, 2009). More broadly, there is an inescapable circularity to arguments about mental metaphors that are based on linguistic observations alone.

A second reason exists for skepticism about the proposed origin of mental metaphors: Even if children go through a developmental stage at which source and target domains are conflated in their minds, a proposal that is compatible with Piaget's (1927/1969) theorizing about cross-domain relationships, the existence of such a stage cannot be interpreted as evidence that children *learn* these conflations on the basis of bodily experience. In principle, source–target mappings that are important for reasoning about the physical and social world could have become part of our mind's "standard equipment" over the time course of human evolution, not of cognitive development: That is, they could be innate (Casasanto, 2010; Casasanto,

[2]George Lakoff and Mark Johnson (1999) appear to have interpreted Christopher Johnson's survey differently from how Johnson (1999) himself did. According to Lakoff and Johnson (1999), conflation is at the levels of direct experience and of conceptualization: "For young children, subjective (nonsensorimotor) experiences and judgments . . . and sensorimotor experiences . . . are so regularly conflated—undifferentiated in experience—that for a time children do not distinguish between the two when they occur together" (p. 46). For C. Johnson, however, the conflation is only at the level of language. Contra Lakoff and Johnson, he wrote that his conflation hypothesis "does *not* rely on the idea that [correlated experiences] are undifferentiated by children—more specifically *there is no claim* that children are incapable of distinguishing visual and mental experiences . . . rather that visual situations provide a good opportunity for adults to talk to children about mental experiences and as a result, children associate 'see' with situations that are both visual and mental" (1999, p. 168, italics added). Thus, it would appear that for C. Johnson, the "conflation hypothesis" refers to a process through which adults' use of metaphoric language influences the relationship between source and target domains in children's minds—not direct physical experience.

Fotakopoulou, & Boroditsky, 2010; Lourenco & Longo, 2011; Srinivasan & Carey, 2010). Increasingly, developmental experiments reveal cross-domain mappings that appear to function like metaphoric source–target relationships in the minds of infants. Ten-month-olds make inferences about social interactions that are consistent with the metaphor *physical size is social dominance* (Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011). Four-month-olds presented with visual and auditory stimuli appear to intuit the metaphor *spatial height is height in musical pitch* (Walker et al., 2010). The fact that these mappings are detectable in infants does not necessarily mean that they are innate; innateness claims are exceptionally hard to support experimentally. However, there is no evidence that many of the mappings Lakoff and Johnson (and others) attribute to bodily experience are *not* innate.

A third reason for skepticism: There is a plausible, well-developed alternative to the proposed *embodied* origin of mental metaphors. Rather than originating in correlations in bodily experience, mental metaphors could originate in correlations in linguistic experience. Consider the mental metaphor *good is up, bad is down*. According to Lakoff and Johnson (1999), this mapping is established as people implicitly learn associations between bodily actions and the emotional states that typically co-occur with them (e.g., standing tall when we feel proud, slouching when we feel dejected). As an alternative proposal, however, mental metaphors could be established through experience using linguistic metaphors. Using spatial words in both literal and metaphoric contexts (e.g., *on top* of the building; *on top* of the world) could cause structural elements of the source domain to be imported into target domain representations in the mind of the language learner, via analogical processes that are not necessarily "embodied" (see Boroditsky, 2000; Casasanto, 2009; French, 2002; Gentner, 1983). Linguistic conventions associating valence with vertical space are reinforced by other nonlinguistic cultural conventions, such as the *thumbs up* and *thumbs down* gestures that indicate approval and disapproval. Once these symbolic conventions exist in language and culture, they can serve as the basis for metaphoric mappings in the minds of individual learners, obviating any role for direct bodily experience in constructing mental metaphors. As humans, we learn a great deal from direct physical interactions with the environment, but we also learn from symbols—and particularly from language. Exposure to metaphors in language should be considered among the possible experiential origins of mental metaphors in individual learners' minds.[3]

[3]The proposal that correlations in linguistic experience give rise to mental metaphors such as *good is up* in the individual learner raises the question of how such linguistic metaphors arose in the first place and why they are so common across languages. It may be that correlations in direct bodily experience resulted in the construction of these linguistic conventions over the time course of biological or linguistic-cultural evolution. Yet even if direct bodily experience is necessary on one of these timescales, it may not be necessary on the timescale of conceptual development in the individual learner (Carey, 2009; Dehaene, 1999).

A fourth reason for skepticism: Some of the embodied experiential bases of metaphors proposed by Lakoff and Johnson (1999) are plausible (indeed, there is a correlation between upright posture and positive mood, which could give rise to the source–target relationship between vertical space and emotional valence in principle), but for other source–target relationships that are deeply entrenched in language and thought, this sort of embodied correlational origin is implausible. For example, behavioral studies have explored *weight* as a metaphoric source domain for *importance*. There is no doubt that people use linguistic metaphors linking weight and importance in English and other languages: a *weighty* opinion is an important opinion. Accordingly, in one experiment, participants rated the importance of messages that they read on either a heavy or a light clipboard. Fair decision-making procedures were judged to be more important when people read about them on a heavy clipboard than on a light one (Jostmann, Lakens, & Schubert, 2009). Jostmann et al. (2009) offered the following as the embodied, correlational basis of the mental metaphor *important is heavy*:

> Gravity is a ubiquitous force in nature that shapes people's bodies and behaviors in fundamental ways. . . . Depending on density and size, some objects are heavier than others, and interacting with heavy objects provides different affordances . . . than interacting with light objects. Being hit by a heavy object generally has more profound consequences than being hit by a light object, and the energetic costs of moving a heavy object are higher than those of moving a light object. Thus, on average, heavy objects have a greater impact on people's bodies than light objects do. Through repeated experiences with heavy objects since early childhood, people learn that dealing with heavy objects generally requires more effort, in terms of physical strength or cognitive planning, than dealing with light objects. People may thus associate the experience of weight with the increased expenditure of bodily or mental effort. (p. 1169)

All of this may be true, but none of this constitutes a plausible experiential basis for the relationship between weight and importance. These experiences could, in principle, form the embodied, correlational basis of a mapping such as *injurious is heavy* or *difficult is heavy*, but not *important is heavy*.

A moment's reflection suggests that if there is any experiential correlation between weight and importance, it is a negative correlation. What do people consider to be most important? Love, friendship, respect, meaningful work, a sense of humor—all weightless. Among physical entities, what do people consider most important: a wedding band, the photo of a soldier's sweetheart on his helmet, money (a $100 bill weighs four hundredths of an ounce—the same as a $1 bill)? Someone's car may be important, and it is heavy, but it is probably not important *because* it is heavy, and a heavier car would not necessarily be more important. How about the relationship between

weight and importance for children during a putative *conflation* stage: Is Dad more important than Mom because he weighs more? Is the dictionary more important than a Dr. Seuss book?

It does not appear to be the case that more weight correlates with more importance in our ordinary physical experiences. It is possible that in previous eras, an experiential correlation between weight and importance was more evident, at least in some symbolic domains such as salary (when it was literally paid in salt) or coins (when they were made of precious metals of particular masses) or when the value of commodities was determined by their weights on balance scales. Expressions in modern languages that link weight with importance could be vestiges of these bygone physical experiences, and using these linguistic expressions could invite language learners to construct a mental metaphor, in which case, the experiential basis of our *importance is weight* mapping would be linguistic experience, not direct physical experience.

In summary, Lakoff and Johnson (1999) advanced the theory that basic mental metaphors are learned obligatorily during the course of cognitive development, on the basis of universally observable correlations between subjective experiences and perceptuomotor experiences. This proposal has been embraced by many scholars and is widely considered to be a fundamental tenet of metaphor theory and of embodied cognition. Yet this proposal has virtually no empirical support, it is implausible in some cases (i.e., where no correlation between source and target domains exists in our everyday experience), and there are at least two credible alternatives to this proposal (i.e., at least some mental metaphors are innate; at least some mental metaphors are learned via linguistic or cultural experience).

Contrary to appearances, we are, as a field, in very much the same situation Lakoff and Johnson described in 1980: We do not know much about the experiential bases of metaphors. And we are unlikely to make progress on the question "Where do our mental metaphors come from?" unless we acknowledge that (a) not all metaphors have an embodied basis and (b) this question has only just begun to be addressed. In what follows, I describe three metaphors that use the same source domain, the lateral (left–right) spatial continuum, which provide unusual theoretical leverage on questions about the experiential origins of metaphors in language and thought.

HOW LANGUAGE CREATES MENTAL METAPHORS: THE LEFT–RIGHT SPATIALIZATION OF POLITICS

In the late 18th century, the French Legislative Assembly was arranged such that the conservative members sat on the right side of the room and the liberal members on the left (Oppenheimer & Trail, 2010). This arrangement

has had enduring consequences. More than 2 centuries later, liberal and conservative values are metaphorized on a left–right continuum, across many languages and cultures, as evidenced by English expressions such as "the liberal left," "centrist politics," and "right-wing conservatives."

These linguistic metaphors appear to correspond to active mental metaphors. In one experiment, U.S. students were asked to sit in a "broken" office chair while completing a political attitudes survey. Unbeknownst to participants, a wheel had been removed strategically from one side or the other, causing the chair to tilt leftward or rightward. Responses showed that, on average, participants who had been assigned to sit in the left-leaning chair expressed more agreement with Democrats (traditionally the more liberal party), whereas participants assigned to sit in the right-leaning chair tended to agree more strongly with Republicans (Oppenheimer & Trail, 2010).

The automaticity with which people activate an implicit left–right mapping of politics was confirmed in a series of reaction time studies in Dutch participants. Although The Netherlands has many political parties, which differ along multiple dimensions, the parties' liberality or conservativism is often described using left–right metaphors (Bienfait & van Beek, 2001). Accordingly, when presented with parties' acronyms, Dutch participants were faster to make judgments about more liberal parties with their left hand (or when the acronym appeared on the left of the screen), and faster to make judgments about more conservative parties with their right hand (or when the acronym appeared on the right of the screen; van Elk, van Schie, & Bekkering, 2010).

Where does this mental metaphor come from? Pointing to its historical roots does not answer this question: That is, the arrangement of 18th century French politicians does not explain how individuals come to intuit a mapping between politics and space today. The left–right mapping of politics is of theoretical interest because it appears to function much like other *orientational metaphors* (Lakoff & Johnson, 1980)—and yet this mapping in language and in thought cannot be acquired through incidental learning of correlations between politics and space in the natural world. It is extremely unlikely, for example, as we encounter others in our environment (e.g., at the dinner table, in the classroom, at the cinema, on the bus) that we see people with liberal views on our left and people with conservative views on our right with such regularity that politics becomes "inevitably" mapped onto left–right space.

Rather than correlations in bodily experience, the obvious origin of this mental metaphor is correlations in linguistic experience. Using the words *right* and *left* in both literal contexts (e.g., the can is *on the left* of the shelf) and metaphoric contexts (e.g., the candidate is *on the left* of the political spectrum)

could cause structural elements of the source domain to be transferred to target domain representations in individual language users' minds, potentially via analogical processes such as those proposed by Gentner (1983).

Before accepting the conclusion that linguistic experience instills this metaphor in individuals' minds, it is important to consider other possibilities. First, in principle, the mapping could be innate (and this implicit mental metaphor biased the arrangement of the French Legislative Assembly). This proposal is dubious: It is unlikely that liberal and conservative political ideologies, or even the concepts of left and right (which are absent from some modern languages and cultures), arose early enough in human history to have been encoded in our genes and neurally hardwired. Second, and more plausibly, the mapping could arise via another source of experience: the spatialization of politics in nonlinguistic cultural conventions. Could it be the case that people acquire this mapping through exposure to graphic representations in the media?

This suggestion presupposes that liberal and conservative political parties or ideologies are, in fact, commonly represented on the left and right respectively, in graphic representations on TV or in newspapers and magazines. Is this true? For example, in the United States, donkeys and elephants symbolize the Democratic and Republican parties, respectively. Often the animals are depicted side by side, presumably to indicate opposition or competition between the parties or to represent the voters' two main alternatives. Is the donkey usually depicted on the left and the elephant on the right?

To address this question, I conducted a brief survey. I ran two queries of Google Images (http://www.google.com; August 24, 2012), using the Advanced Image Search function to restrict the search to U.S. websites. The search terms were *donkey elephant* for the first query and *elephant donkey* for the second. Each search yielded more than 3 million images. Visual inspection of the first 10 pages displayed for each query confirmed that the majority of the images conformed to the following criteria: (a) They showed exactly one donkey and one elephant, (b) one animal was clearly located to the right (or left) of the other, and (c) the depictions appeared to be intended to symbolize the Democratic and Republican parties (i.e., they were not nature photos that happened to contain these animals). For most images, this intention was clear from the blue and red colors of the donkey and elephant, stars and stripes motifs, political slogans, pugilistic attitudes of the animals toward each other, or the personification of the animals (e.g., dressing them in suits and ties, placing them under the Capitol dome). The images appeared to come from political cartoons, TV news backdrops, or campaign materials (e.g., hats, T-shirts, bumper stickers, posters).

To sample the images in an unbiased manner, I selected the first 50 images from each query that met the three criteria and that were not redundant with any previously selected image. I then tabulated and compared the number of images in which the donkey was on the left of the image and the elephant on the right (metaphor-congruent images) and the number in which the positions were reversed.

The results were clear. Of the 100 images sampled, 51 (51%) were metaphor-congruent and 49 (49%) were metaphor-incongruent (sign test $p = .92$). The order of the search terms did not significantly affect the metaphor-congruity of the images ("donkey elephant": 27 [54%] metaphor-congruent, 23 [46%] metaphor-incongruent; "elephant donkey": 24 [48%] metaphor-congruent, 26 [52%] metaphor-incongruent; $\chi^2(1) = 0.36$, $p = .55$).

The donkey and the elephant, the most widely recognizable nonlinguistic symbols of political orientation in U.S. politics, are often depicted side by side. Yet according to this (preliminary) survey, these depictions do not reliably spatialize the animals according to the left–right political metaphor that is found in Americans' language and thought. It is not clear why they do not: In some cases, other design constraints might outweigh spatializing the animals according to the left–right metaphor. Alternatively, unlike some other spatial relationships (e.g., up–down), right–left depends on perspective. In many images, the donkey and elephant are facing out of the page, toward the viewer. In such cases, an artist who wished to make their spatial locations congruent with the *left is liberal* convention would have to decide whether to place the donkey on the viewer's left or on the elephant's left (i.e., the viewer's right). The apparent randomness of the positions of the animals in the images surveyed could reflect artists expressing the left–right mental metaphor graphically but making different choices about whose left–right perspective to adopt. The ambiguity introduced by a reversible spatial perspective could also explain why candidates are not always placed in metaphor-congruent locations on our TV screens: In the last debate of the 2008 U.S. presidential campaign the Democrat (Barack Obama) was on the left and the Republican (John McCain) on the right, but in the first debate of the 2012 campaign the Republican (Mitt Romney) was on the left and the Democrat (Obama) on the right of the screen.[4]

Whatever the reason for the apparent lack of any systematic use of left–right space in these political depictions, the implications for the present question are clear. If political parties or ideologies are not systematically spatialized in the media and in nonlinguistic graphic conventions, these conventions cannot be responsible for establishing the spatial mappings in people's minds. It appears that talking about liberal and conservative political attitudes in terms of space is what causes people to think about them that way—a conclusion that awaits further experimental validation.

[4]The U.S. Senate and House are arranged similarly to the 18th century French Legislative Assembly, but people who are not members of the Senate or House are unlikely to be exposed to this spatialization of the political "left" and "right" with sufficient frequency to give rise to an implicit mental metaphor. Furthermore, the viewpoint from which the Senate or Congress are depicted varies between photographs and videos, sometimes showing the Democrats and Republicans in metaphor-congruent and sometimes in metaphor-incongruent sides of viewer-centered space.

HOW THE BODY CREATES MENTAL METAPHORS: THE LEFT–RIGHT SPATIALIZATION OF VALENCE

Across many cultures, the right side is associated with things that are good and lawful and the left side with things that are dirty, bad, or prohibited. The association of *good* with *right* and *bad* with *left* is evident in positive and negative expressions like *my right-hand man* and *two left feet*, and in the meanings of English words derived from the Latin for *right* (dexter) and *left* (sinister).

Do people *think* about good and bad things in terms of left–right space? For example, do people tend to feel more positively about things that appear on one side of space and more negatively about things that appear on the other side? Until recently, the answer appeared to be no. According to Tversky (2001),

> despite the fact that most people are right-handed and terms like dexterity derived from "right" in many languages have positive connotations and terms like sinister derived from "left" have negative connotations, the horizontal axis in graphic displays seems to be neutral. (p. 101)

Some links between right–left space and positive and negative evaluation were documented (e.g., the preference for stockings hung on the right of a clothes hanger; Wilson & Nisbett, 1978), but such effects were unpredicted and explained post hoc in terms of temporal order, not spatial position.

More recently, however, studies have revealed that people *do* implicitly associate "positive" and "negative" emotional valence with "right" and "left" but not always in the way that linguistic and cultural conventions suggest. Rather, associations between valence and left–right space depend on the way people use their hands to interact with their physical environment (for a review, see Casasanto, 2011). In one series of experiments, when asked to decide which of two products to buy, which of two job applicants to hire, or which of two alien creatures looks more honest, intelligent, or attractive, right- and left-handers tended to respond differently: Right-handers tended to prefer the product, person, or creature presented on their right side, but left-handers tended to prefer the one on their left (Casasanto, 2009). This

pattern persisted even when people made judgments orally, without using their hands to respond. Other experiments show that children as young as 5 years old already make evaluations according to handedness and spatial location, judging animals shown on their dominant side to be nicer and smarter than animals on their nondominant side (Casasanto & Henetz, 2012).

The implicit association between valence and left–right space influences people's memory and their motor responses as well as their judgments. In one experiment, participants were shown the locations of fictitious positive and negative events on a map and asked to recall the locations later. Memory errors were predicted by the valence of the event and the handedness of the participant: Right-handers were biased to locate positive events too far to the right and negative events too far to the left on the map, whereas left-handers showed the opposite biases (Brunyé, Gardony, Mahoney, & Taylor, 2012). In reaction time tasks, right- and left-handers were faster to classify words as positive when responding by pressing a button with their dominant hand and faster to classify words as negative when responding with their nondominant hand (de la Vega, de Filippis, Lachmair, Dudschig, & Kaup, 2012).

Associations of handedness with valence and space have been observed beyond the laboratory, in the speech and gestures of right- and left-handed U.S. presidential candidates during televised debates in 2004 and 2008 (Casasanto & Jasmin, 2010). In right-handers (Bush, Kerry), right-hand gestures were more strongly associated with positive-valence speech than left-hand gestures, and left-hand gestures were more strongly associated with negative-valence speech than right-hand gestures; the opposite associations between hand and valence were found in left-handers (McCain, Obama), despite the centuries-old tradition of training public speakers to gesture with the right hand for good things and the left hand for bad things (or not to use the left hand at all; Quintilianus, 1920).

Together, these data from studies using questionnaires, reaction time tasks, map tasks, and spontaneous gestures suggest that the mental metaphor *good is dominant side–bad is nondominant side* is habitually activated, with a high degree of automaticity, when people evaluate the positivity of stimuli or recall information with a positive or negative valence. These findings provide one line of support for the body-specificity hypothesis (Casasanto, 2009), which posits that people with different kinds of bodies should tend to think differently in predictable ways, specifically due to the ways their bodies constrain their interactions with the physical environment.

Where does this mental metaphor come from? Casasanto (2009) proposed that people come to associate *positive* with their dominant side of space because they can usually interact with their physical environment more fluently on this side, using their dominant hand. This proposal follows from the

finding that fluent perceptuomotor interactions with the environment generally lead to more positive feelings, whereas disfluent interactions lead to more negative feelings and evaluations (e.g., Ping, Dhillon, & Beilock, 2009).

To test whether manual motor fluency drives associations between valence and left–right space, Casasanto and Chrysikou (2011) studied how people think about *good* and *bad* after their dominant hand had been impaired, reversing the usual asymmetry in motor fluency between their right and left hands. This reversal of motor fluency resulted in a reversal of behavioral responses: Natural right-handers whose right hand was permanently impaired by a unilateral stroke or temporarily by wearing a cumbersome glove on the right hand in the laboratory tended to associate *good* with the left side of space, like natural left-handers.

These results demonstrate a causal role for motor experience in determining the relationship between valence and left–right space in people's minds. In the short term, even a few minutes of acting more fluently with the left hand than the right can cause natural right-handers to associate *good* with *left*. The effects of short-term motor asymmetries are presumably temporary, but the same associative learning mechanisms that change people's judgments in the laboratory may result in the long-term changes found in stroke patients and may establish natural right- and left-handers' mental metaphors for valence in the course of ordinary motor experience.

Do regularities in language or culture contribute to the implicit left–right mapping of valence in people's minds? So far, there is no evidence that they do. Writing direction, for example, does not appear to have any effect on the strength of this mapping, nor does the presence of stringent taboos against use of the left hand, as evidenced by the finding of similar experimental results in Moroccan Arabs as in American, Spanish, and Dutch participants (de la Fuente, Casasanto, Román, & Santiago, 2011). It would be reasonable to posit that within a culture, influences of motor fluency and linguistic conventions could combine to shape people's left–right metaphors for valence. In principle, people could have *two* mental metaphors linking valence with left–right space: one based on patterns in language and culture and the other on patterns of direct bodily experience. If so, the two mappings would be congruent for right-handers (for whom both associate *good* with *right*) but incongruent for left-handers (for whom language and culture associate *good* with *right* but bodily experience associates *good* with *left*). This conjecture makes a prediction: Assuming the influences of the two metaphors on an individual's behavior are roughly additive, the *good is right* bias in right-handers should be stronger than the *good is left* bias in left-handers. Yet this prediction is disconfirmed by the results of numerous experiments (e.g., Casasanto, 2009; Casasanto & Henetz, 2012; Casasanto & Jasmin, 2010). Across studies, the body-specific *good is left*

mapping tends to be stronger in left-handers than the *good is right* mapping in right-handers. To date, there is no evidence that *good is right* idioms in language or culture influence implicit left–right mental metaphors for valence.

Overall, these results cannot be explained by experience with language and culture, which consistently associate *good* with *right*. Linguistic and cultural experience, therefore, cannot be the origin of the robust association between *good* and *left* found in left-handers. Furthermore, the association of *good* with one side or the other cannot be (entirely) innate, because it has been shown to depend on long- and short-term motor experience. The body-specific left–right mapping of valence provides one example—arguably the *only* example to date—of a mental metaphor that can be shown to depend on correlations between subjective experiences (i.e., of valence) and motor experiences, learned implicitly as individuals interact with their physical environment.

Does the discovery of a body-based mapping between space and valence validate Lakoff and Johnson's (1999) proposal that mental metaphors originate in correlations between perceptuomotor and subjective experiences? In the broadest sense it does, but in the details it does not. There is no evidence, for example, that right-handed children go through a developmental phase of source–target conflation, during which their conceptions of *bad* and *leftward in space* are fused and gradually become differentiated; it would be surprising if this were the case. It would be even more surprising if such a process of conceptual conflation and differentiation were responsible for the reversal of the left–right valence mapping observed in unilateral stroke patients and in ski-glove-trained college students (Casasanto & Chrysikou, 2011). Rather than illustrating the specific process conflation-and-differentiation proposed by Lakoff and Johnson (1999), the left–right mapping of valence illustrates a more general process by which perceptuomotor and subjective experiences may become associated and used inferentially as a mental metaphor.

HOW CULTURE SHAPES MENTAL METAPHORS: THE LEFT–RIGHT SPATIALIZATION OF TIME

The left–right mappings of politics and of valence are special cases: A purely linguistic origin can be established for politics (or at least a largely linguistic origin, allowing for the possibility of as-yet-undetected influences of other cultural experiences), and a purely bodily origin can be established for valence. There may be no comparable case in which nonlinguistic cultural conventions can be shown to be responsible for establishing a mental

metaphor, de novo. However, the left–right mapping of time provides an illustration of how culture can shape what may be preexisting mental metaphors, determining crucial aspects of implicit associations between time and space.

Often, the way people talk about time using spatial metaphors corresponds to the way they spatialize time in their minds. In English, spatial metaphors for temporal sequences suggest that events in time flow along the sagittal (front–back) axis: Deadlines lie *ahead of us* or *behind us;* we can *look forward* to our golden years or *look back* on our greener days (Clark, 1973). These linguistic metaphors appear to correspond to an active mental metaphor. In one study, for example, English speakers were found to lean forward when thinking about the future and lean backward when thinking about the past (Miles, Nind, & Macrae, 2010).

Yet the way people use space to talk about time is not necessarily the way they use space to think about it. No known spoken language uses the lateral (left–right) axis to talk about time conventionally, and invented left–right metaphors for time may sound nonsensical: Monday comes *before* Tuesday, not *to the left of* Tuesday (Casasanto & Jasmin, 2012; Cienki, 1998). Despite the total absence of left–right metaphors in spoken language, however, there is strong evidence that people implicitly associate time with left–right space. Furthermore, the direction in which events flow along people's imaginary timelines varies systematically across cultures. Events flow rightward in cultures whose literate members use a left-to-right orthography and leftward in cultures that use a right-to-left orthography (e.g., Fuhrman & Boroditsky, 2010; Ouellet, Santiago, Israeli, & Gabay, 2010; Tversky, Kugelmass, & Winter, 1991).

Does this mean that the left–right mapping of time in people's minds has its origin in the cultural practice of reading and writing? It is not possible to make this causal inference on the basis of cross-cultural data, which are correlational. In principle, a writing system could emerge with one directionality or another as a *consequence* of culture-specific conceptions of time—not a cause. Furthermore, cultural practices tend to covary. There are other well-established nonlinguistic cultural conventions by which time is habitually spatialized from left to right. These include spontaneous gestures and graphic conventions in calendars, graphs, and timelines.

Casasanto and Bottini (2013) conducted a series of experiments to investigate whether experience reading a particular orthography can determine the direction and orientation of the mental timeline. Dutch speakers performed space–time congruity tasks with the instructions and stimuli written in either standard, mirror-reversed, or rotated orthography. Reading requires scanning the page in a particular direction. Normally, for readers who use the Roman alphabet, reading each line of a text requires moving one's eyes (and one's

attention) gradually from the left to the right side of the page or the computer screen. As such, moving rightward in space is tightly coupled with "moving" later in time. If the habit of reading from left to right contributes to an implicit left-to-right mapping of time in readers' minds, then practice reading in the opposite direction should eventually reverse this mapping. By the same logic, reading top-to-bottom or bottom-to-top should cause the usual space-time mapping to be rotated 90 degrees clockwise or counterclockwise.

Consistent with these predictions, when participants judged temporal phrases written in standard orthography, their reaction times were consistent with a rightward-directed mental timeline. After exposure to mirror-reversed orthography, however, participants showed the opposite pattern of reaction times; their implicit mental timelines were reversed, like those observed in members of right-to-left reading cultures. When standard orthography was rotated 90 degrees clockwise (downward) or counterclockwise (upward), reaction times indicated that participants' mental timelines were rotated accordingly. These results show that reading can play a causal role in shaping people's implicit time representations, even when other cultural, linguistic, and environmental factors are held constant. Exposure to a new orthography can change the direction and orientation of the mental timeline within minutes—even when the new space-time mapping directly contradicts the reader's usual mapping—illustrating both the automaticity and the flexibility with which people activate spatial schemas for temporal order.

The data showing that reading experience is sufficient to determine the orientation direction of the mental timeline should not be interpreted as indicating that reading or writing experience is *necessary* for fixing its direction or that reading and writing are the only cultural practices that could contribute to the specifics of the mental timeline beyond the laboratory. For the present discussion, it is important to note that the direction of the mental timeline could not be due to correlations in linguistic experience because time is not mapped to left–right space in spoken language. It could not be due to correlations in bodily experience with the natural environment because natural space–time correlations are not direction-specific (i.e., it is not the case that earlier events tend to occur on our left and later events on our right, or vice versa). The orientation and direction of the mental timeline must depend on *some* aspect (or aspects) of nonlinguistic cultural experience.

CONCLUSION

It is widely accepted that mental metaphors have an embodied origin: According to Lakoff and Johnson (1999), they are inevitably learned during the course of cognitive development, on the basis of correlations between

subjective experiences and perceptuomotor experiences as children interact with the physical environment, due to universal properties of the body, brain, and world. Yet despite widespread acceptance of this view, there is little evidence to support it, and there is some clear evidence against it.

It may be difficult to determine the experiential origins of most of the mental metaphors that have been studied. Many metaphors are like *good is up:* They could be innate, or they could have their basis in linguistic experience (e.g., using expressions such as *feeling up* or *down*), cultural experience (e.g., using gestures such as *thumbs up*), or bodily experience (e.g., standing upright when we feel proud). Behavioral experiments validating the *good is up* mapping are consistent with all of these possibilities and are therefore uninformative about the origins of this mental metaphor, or others like it.

Fortunately, for at least a few mental metaphors, the experiential origins can be determined unambiguously, thus illustrating a range of possible origins for other mental metaphors. The left–right mapping of politics could not be based on correlations between subjective and perceptuomotor experiences with the natural environment, it is not likely to be innate, and it does not appear to be grounded in nonlinguistic cultural conventions; rather, it appears likely to arise, largely or entirely, on the basis of correlations in linguistic experience. By contrast, the left–right mapping of emotional valence could only arise from correlations in bodily experience (although not necessarily on the "conflation" of space in valence in early childhood, as posited by Lakoff & Johnson). The left–right mapping of time, in contrast, illustrates the role of nonlinguistic cultural practices in shaping preexisting source–target mappings and demonstrates how mental metaphors can be culture-specific at one level of analysis but may be universal at another.

Determining the experiential origins of our mental metaphors requires looking beyond the body and considering how our experiences of interacting with both the physical environment and social environment shape our minds.

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METAPHOR RESEARCH IN SOCIAL-PERSONALITY PSYCHOLOGY: THE ROAD AHEAD

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Lakoff and Johnson (1980) suggested that people think, feel, and behave in metaphoric terms. This is a fascinating perspective on human nature but one that has only recently been put to the test empirically. Despite the fact that such investigations have been recent—arguably less than 10 years old—an impressive body of evidence has supported conceptual metaphor theory (CMT; Landau, Meier, & Keefer, 2010). Each chapter in this volume shows, in its own way, that this emerging research area enhances our understanding of diverse social phenomena and, more generally, the cognitive underpinnings of human meaning making. Yet with each discovery, new research questions and theoretical controversies come to light. In this final chapter, we offer some suggestions that researchers might find useful as they create, refine, and test theories of metaphor's significance in social life. Some of these suggestions are inspired by CMT; others are based more generally on a critical

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