Cognition From on High and Down Low: Verticality and Construal Level

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Across 7 studies, the authors examined the relationship between experiences of verticality and abstract versus concrete processing. Experiencing high, relative to low, verticality led to higher level identifications for actions (Study 1), greater willingness to delay short-term monetary gains for larger long-term monetary gains (Studies 2 and 5), and more frequent perceptions of meaningful relationships between objects and categories (Studies 3, 4, and 6), demonstrating that high verticality leads to more high-level construals. Mechanisms of these effects were explored, and the studies present evidence suggesting that mood (Studies 3 and 4), felt power (Study 4), arousal (Study 4), perceptual scope (Study 4), superficial semantic associations (Study 5), and movement (Study 5) do not mediate these effects. Instead, we found that even minimal experiences of verticality influence construal level (Study 6) and that verticality can influence construal level independent of the many plausible mediators. Furthermore, the relationship is reciprocal with abstract and concrete processing influencing the verticality of one's visual perspective (Study 7), suggesting an intimate link between construal level (abstract vs. concrete processing) and experiences of verticality.

Keywords: construal level, cognitive processing, verticality, metaphor

A common belief is that wisdom is gained from up on high. In his final speech, Dr. Martin Luther King, Jr., for example, proclaimed that he had been to the mountaintop and had gained there a vision of where humankind ought to be. Likewise, numerous religions suggest enlightenment is achieved through *ascension*, or learning to exist at a higher plane. Transcendentalists such as Ralph Waldo Emerson urged people to move beyond physical, concrete knowledge so as to realize humankind's true relation to the world. Psychologists have made similar suggestions. For example, Abraham Maslow proposed that peak experiences allow people to gain greater coherence and meaning in life.

Drawing from work that examines the relationship between conceptual and perceptual processing (e.g., Trope & Liberman, 2010) and integrating it with recent insights into the interplay between sensorimotor and conceptual processes (Barsalou, 2008; Lee & Schwarz, 2012; Slepian & Ambady, 2014), we suggest that experiences of verticality might enable people to perceive greater meaning and coherence around them. We provide an account for this link and introduce new concepts and theory that extend work on processing style, construal level, perceptual symbols, and metaphor. We examined whether experiences of high verticality promote an abstract processing style and an awareness of superordinate relationships, whereas experiences of low verticality induce a focus on more concrete details. The current work thus examines the correspondence between verticality (from high to low) and construal level (from high to low).

Across seven studies spanning numerous domains, we demonstrate a bidirectional influence between experienced verticality and construal level. We propose that construal level might be related to experiences of verticality by means of sensorimotor and metaphor mechanisms that originate from a relationship between verticality, perceptual scope, and construal level. That is, we propose that through the simple increased probability of attaining greater perceptual scope during experiences of relatively high verticality, such experiences will become associated with greater conceptual scope, or relatively high construal levels (e.g., Derryberry & Tucker, 1994).

Crucially, however, we suggest that through this relationship a *sensorimotor metaphor* for processing style will develop, whereby later experiences of verticality can still enhance construal level, even if those experiences do not actually allow people to see more (i.e., increase perceptual scope). In examining this relationship, we assess several alternative hypotheses, testing for roles of mood, movement, arousal, felt power, and perceptual scope. Over and above any influence of other potential mediators, we find the

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predicted relationship between verticality and construal level. We thus propose that the experience of verticality is linked with information processing style via sensorimotor metaphor mechanisms, which brings a number of implications for research on construal level, psychological distance, and grounded cognition as well as creativity, insight, categorization, action identification, decision making, and person perception.

Concrete Versus Abstract Construals

People can construe objects, actions, and events at concrete or abstract levels (i.e., at low or high levels; Trope & Liberman, 2010; Vallacher & Wegner, 1987). College students might construe their actions in relatively concrete terms by thinking of themselves as sitting in a classroom and listening to a professor. Others might construe the same actions more abstractly as getting an education and learning about psychology. Descriptions of objects might likewise vary. A textbook might be thought of concretely at a low level, as papers bound together, or abstractly at a high level, as a pedagogical device.

Abstract and concrete representations trade off in details and meaning. Concrete representations favor details: they capture specific features, behaviors, and contexts, but they do not capture information about meaning or goal relevance. Abstract representations sacrifice behavioral and contextual details to favor information about why the action is taking place, what purpose the action is serving, and how it might relate to other events and behaviors.

How a person construes an object or event has implications for a variety of processes, ranging from decision making to creativity to person perception to self-regulation (Trope & Liberman, 2010). A concrete processing style, for instance, facilitates difficult motor actions (Vallacher & Wegner, 1987) and tasks that require attending closely to the immediate environment (e.g., vigilance tasks; Schmeichel, Vohs, & Duke, 2011). An abstract processing style, in contrast, facilitates the pursuit of meaningful, long-term goals over short-term gains (Fujita, Trope, Liberman, & Levin-Sagi, 2006). Therefore, how one construes the world can determine in part how one behaves.

Verticality and Construal Level

The present article examines the link between construal level and verticality, which is one of the physical dimensions most widely studied in relation to cognition. Lakoff and Johnson (1980) noted that upward and downward physical location is used metaphorically to represent similar dimensions among abstract concepts. For instance, happy is up and sad is down, health and life are up and sickness and death are down, powerful is up and powerlessness is down, and virtue is up and depravity is down.

Lakoff and Johnson (1980) predicted that this metaphorical language suggests a grounding of abstract concepts in concrete experiences of verticality. A large and growing body of work has confirmed this prediction. Experiences of verticality have been found repeatedly to influence cognition in ways that are congruent with common metaphors. Words with affectively positive connotations (e.g., "hero"), which are associated metaphorically with high verticality, are categorized more quickly when shown in the upper portion of a computer screen, whereas words with affectively negative connotations (e.g., "liar"), which are associated metaphorically with lower verticality, are categorized more quickly when in the lower portion of the screen, demonstrating conceptual metaphors for affect (Meier & Robinson, 2004; see also Meier & Robinson, 2006). Similarly, powerful groups are judged as powerful more quickly when high on a computer screen than when low, and the converse is true for powerless groups (Schubert, 2005). Along the lines of the virtue and divinity is up metaphor, participants judged individuals presented in the upper, relative to lower, portion of the screen as having stronger beliefs in God (Meier, Hauser, Robinson, Friesen, & Schjeldahl, 2007).

Prior work has examined the relationship between verticality and a variety of concepts. The present work, in contrast, examines whether verticality might be related to construal level, that is, a processing style that can apply to any concept. Using a linguistic analysis, as did Lakoff and Johnson (1980), one can see that there is clear metaphorical language relating construal level to verticality. Many authors label abstract construals as high-level construals and concrete construals as low-level construals (e.g., Trope & Liberman, 2010; Vallacher & Wegner, 1987). Lay psychologists too use similar language when describing gaining insight, meaning, or transcendent, abstract thought (as in the opening examples).

We suggest that this metaphor is likely founded on an experiential correlation between verticality and construal level. We propose that the tendency for verticality to cause shifts in construal level derives from experiences in which verticality and construal level have been linked by a third variable: perceptual scope. Prior work demonstrates that increased perceptual scope (which allows one to see more and hence to see greater coherence rather than details) can enhance conceptual scope (appreciating the larger, abstract meaning, rather than concrete low-level details; e.g., seeing the forest for the trees; see Friedman et al., 2003). In this way, because high verticality affords greater perceptual scope, it should afford greater conceptual scope, or higher construal levels.

Experiences of relatively high verticality afford greater perceptual scope than is available when vertically low (e.g., seeing many trees from above vs. a few from below). And this enhanced perceptual coherence should lead to greater conceptual coherence, relatively higher construal levels (i.e., seeing how objects fit together as a group). We propose that via sensorimotor metaphor mechanisms, relatively high verticality and high construal level can mutually influence each other, even independent of any influence of perceptual scope. This proposal suggests a novel extension of prior work on metaphor and cognition. That is, prior work on the role of sensorimotor states and metaphor in cognition has focused on groundings of concepts. Here, however, we explore a grounding of a processing style and suggest that a sensorimotor metaphor can ground a processing style.

The original theory of conceptual metaphor (Lakoff & Johnson, 1980, 1999) suggests that because metaphors serve a unidirectional epistemic function, their direction of influence is unidirectional as well. That is, according to conceptual metaphor theory (Lakoff & Johnson, 1980, 1999), metaphors serve the purpose of making abstract concepts more concrete. This mapping of concrete sensations to abstract concepts leads sensations to influence conceptual processing. The converse, however, was originally hypothesized to not occur (i.e., conceptual processing of a metaphor is suggested to not influence sensorimotor processing; e.g., Miles et al., 2010; Schneider et al., 2013; Slepian, Rule, & Ambady, 2012). Recently,

however, researchers have demonstrated that conceptual metaphors can indeed lead to bidirectional influences. For example, in line with a suspicion-is-fishy-smelling metaphor, Lee and Schwarz (2012) demonstrated that fishy scents make others seem more suspect and that suspicion enhances the ability to detect the scent of fish oil. In addition, Slepian and Ambady (2014) found that when participants were exposed to a metaphor linking the past with heaviness, an old-looking object (seemingly from the past) was judged as heavier than a new-looking object (seemingly from the present), whereas precisely the reverse occurred for participants exposed to a metaphor linking the present with heaviness. These influences were found only when handling the object (not when merely seeing an image of the object), implicating an influence on sensorimotor processing. Thus, because of the dynamic online interaction between sensorimotor and conceptual processing, and the structure of metaphor itself, conceptual metaphors that refer to sensorimotor states can lead to bidirectional influences between such sensorimotor and conceptual processes (Slepian, 2015; Slepian & Ambady, 2014). Although previous work has characterized bidirectional influences between sensorimotor and conceptual processing to be indicative of a non-metaphor-based mechanism, this recent work reveals that because metaphors can be represented, in part, through sensorimotor activity, bidirectional influences can indeed occur from metaphor (Lee & Schwarz, 2012; Slepian & Ambady, 2014).

One extension to prior work, explored here, is whether not only can a concept be grounded via sensorimotor metaphor, but whether so too can a processing style (concrete vs. abstract), which determines how any concept is construed. We describe our account next of how construal level, in particular, can be grounded in experiences of verticality.

Sensorimotor Metaphor Grounding of Construal Level

In the current work, we explore perhaps one of the most widely studied information processing styles in the psychological literature: the dimension of concrete to abstract processing, also described as low- to high-level construals, respectively. Recall that one way in which high verticality might promote high construal processing is through enhanced perceptual scope (because of the mutual influences between conceptual and perceptual scope; Friedman et al., 2003). We wish to propose, however, that the relationship that verticality and construal level share with perceptual scope serves only as a starting point for the formation of two other potential associations, one sensorimotor-based and the other metaphor-based. Once formed, we suggest that these new sensorimotor and metaphor-based connections will allow for mutual influences between verticality and construal level, independent of perceptual scope.

The experience of high verticality has (a) perceptual components (seeing oneself high up), (b) motor components (the proprioceptive and motor experiences associated with ascension), and (c) cognitive components (the conceptual processes associated with thinking about being high up). Each of these components has the potential to become linked to high construal level through experience (see Barsalou, 2008).

Sensorimotor grounding through conjoint activation. One novel proposal of the current work is that the same sensorimotor mechanisms that link instantiations of concepts with sensorimotor processes can extend to instantiations of information-processing styles. A processing style describes how an object is construed, rather than properties of the object itself. As discussed in Barsalou's (1999) perceptual symbol systems theory, when considering a concept, people demonstrate simulations, or partial reactivations of sensorimotor processes involved in previous physical interactions with that concept, and through these processes, concepts become grounded in the sensorimotor system. For example, thinking about a collection of trees will lead to sensorimotor activations related to what trees look like (e.g., tall, green), what they feel like (e.g., their rough bark, the cool shade that they provide), and related physical actions (e.g., hiking), grounding the concept of "trees" in these multimodal experiences. And yet, a collection of trees can be construed at a low-level, as simply "trees," or at a high level, "a forest." We propose that—just as neural ensembles bind diverse aspects of cognitive computations involved in the instantiation of a concept (allowing for bidirectional influences; Barsalou, 2008)—a similar process can occur for the instantiation of a processing style.

As discussed in the introduction, the experience of high verticality increasing construal level is, anecdotally, a common one and likely an immediate consequence of the increased perceptual scope afforded by relative high verticality. Yet over time, verticality and construal level might become sufficiently linked as to influence one another even in the absence of any increase in perceptual scope. Prior work has postulated the mechanisms that allow neural ensembles to integrate co-occurring computations across the cortex for neural instantiations of concepts (Barsalou, 1999). The same sort of integration should also occur for instantiations of processing styles. Specifically, experiences promoting the co-occurring activation of sensorimotor processes of verticality and an abstract processing style should precipitate such integration.

In other words, by the same processes that allow for concepts to be, at least in part, neurally instantiated as a collection of sensorimotor activity associated with physical experience with the concept (supporting the development of conceptual metaphors; Lakoff & Johnson, 1999), we should find evidence for a similar link between sensorimotor activity and associated processing styles. Indeed, the mechanisms that make these links in Barsalou's (1999) perceptual symbol systems theory, which can extend to metaphors (Slepian & Ambady, 2014), are based partly on Damasio's (1989) theory of convergence zones and are thus founded on mechanisms that are "uninformed as to the content of the representations they assist in attempting to reconstruct" (p. 46). In prior work, the content of such representations has been concepts, but they might also include information processing styles.

Sensorimotor grounding through metaphor. Through the mechanisms described in the preceding paragraphs, perceptual and motor experiences of verticality can come to ground construal level. We also suggest a second manner in which construal level can become linked to verticality, one that does not rely on extensive personal experience of verticality being paired with high construal level. As discussed in the opening examples, Martin Luther King, Jr., Ralph Waldo Emerson and Abraham Maslow (to provide just a few examples) each described personal experiences with high construal level by using the metaphor of high verticality. These examples suggest that the metaphor for construal level referencing sensorimotor verticality is somewhat commonplace. We propose that exposure to this metaphor might lead construal

level to become associated with sensorimotor states. This proposition is based on evidence that merely conceiving of sensory states leads to modality-specific neural simulations of those states (e.g., Belardinelli et al., 2009) and thus acquiring a metaphor that gives reference to sensory states can, by the same mechanisms described earlier, lead sensorimotor processing (associated with verticality) to become involved in instantiations of abstract (vs. concrete) processing styles (for evidence that this occurs with concepts, see Slepian & Ambady, 2014).

In sum, the current work makes a number of theoretically derived predictions. It predicts that construal level is grounded in verticality. In doing so, it also predicts that the same sensorimotor metaphor mechanisms that allow for the grounding of concepts, should allow for the grounding of processing style. In reviewing the literature, we identified other equally plausible mechanisms for an association between construal level and verticality: mood, movement, arousal, felt power, and perceptual scope, each of which we explore and describe in the following paragraphs.

The Current Research

The current work tested for a correspondence between verticality and construal level across numerous domains, including action identification (Study 1), monetary decision making (Studies 2 and 5), categorization (Studies 3, 4, and 6) and perceptual decisions (Study 7). We also examined whether the effect of verticality on construal level was mediated by mood (Studies 3 and 4), felt power (Study 4), arousal (Study 4), perceptual scope (Study 4), superficial semantic activation (Study 5), movement (Study 5), and experiences of verticality (Study 6). In addition, we examined whether construal level would influence verticality outcomes (Study 7). In sum, across seven studies we examine the relationships between verticality and construal level, and how the former might be associated with, influence, and be influenced by the latter.

If verticality influences construal level, it has a wide range of implications. For instance, construal level has a pervasive influence on visual perception, categorization, action identification, and person perception, among other domains (see Trope & Liberman, 2010), and experiences of verticality are ubiquitous, whether walking up or down a flight of steps, standing on a hill, looking out a window, or admiring a large monument from below. A relationship between the two suggests that simple experiences of verticality could influence how objects are perceived, how goal pursuit unfolds, how creative one is, or how another person is treated. We explore these implications in the current work and also discuss the theoretical implications for construal level, psychological distance, and cognitive processing.

In all seven studies, we report all data exclusions (if any), all manipulations, and all measures. In all our studies, we planned to collect at least 20 observations per condition (see Simmons, Nelson, & Simonsohn, 2011). We were successful in collecting at least 20 participants per condition except for two studies conducted at the end of a semester, with fewer available participants. Both effects, however, are replicated later in the article.

Study 1

In a first examination of whether verticality influences construal level, we tested whether walking up or down a flight of steps would consequently change how actions were construed. Actions can be construed at a relatively high level, which describes the intentions behind an action. For instance, locking a door might be construed as securing the house. Or actions can be construed at a relatively low level. For instance, locking a door might be construed as turning a key (Vallacher & Wegner, 1987). We expected that experiencing increases in verticality (walking up a flight of steps) would lead individuals to construe actions at higher, more abstract levels, relative to experiencing decreases in verticality (walking down a flight of steps), which would lead individuals to construe actions at lower, more concrete levels.

Method

An experimenter blind to the hypothesis approached participants ($N = 40$) after they had just ascended or descended a flight of stairs on a university campus.[1] Participants were approached across three different staircases: (1) indoors inside a university campus center that had a landing in the middle of the staircase, and a 90° turn at that landing; (2) indoors inside a library, a straight staircase with no landing; and (3) a large staircase outdoors that serves as a main entrance to the university. The two indoor staircases did not offer views of the outdoors (e.g., through a window), and across all staircases the first and second levels offered similar views of different indoor rooms in the first two cases and buildings in the last case. There were no a priori reasons to suspect participants who happened to be ascending versus descending a staircase to already differ from one another in construal level (i.e., before taking the stairs). Our primary reason for using multiple staircases was to therefore increase the generalizability of this independent measure given its quasi-experimental nature, and thus these staircases were used for Studies 1 through 3 (Study 4 then specifically manipulates ascension and descension).

After having just ascended or descended a flight of stairs (to the first or second level; i.e., not a landing), participants were asked to volunteer for a survey and completed 10 items from the Behavioral Identification Form (Vallacher & Wegner, 1987) that, according to a pilot study ($N = 25$), were on average evenly divided between being identified at high and low levels (see Table 1). The order of the two response options per action was counterbalanced across participants.

Results and Discussion

As predicted, participants described the actions more often at a higher level after ascending the steps ($M = 50.53\%$, $SD = 18.10$) than after descending the steps ($M = 38.25\%$, $SD = 15.62$), $t(38) = 2.30$, $p = .03$, $r = .35$. This study provides initial evidence that experiences of verticality influence construal level. Simply walking up rather than down a flight of stairs caused participants to describe simple actions in more meaningful ways. In the next study we sought to examine whether verticality would influence a form of decision making known to vary with construal level.

[1] For Studies 1, 2, and 5, gender was not recorded for the volunteer participants. For Studies 1 through 6, age was not recorded, but all participants in those studies were undergraduates. For the studies in which gender was not recorded, we can assume similar distributions of gender as other studies that approach students on the university campus (about 57% female).

Table 1
Items From 10-Item Behavioral Identification Form Used in Study 1

Item	Behavior
Picking an apple	Getting something to eat OR pulling an apple off a branch
Painting a room	Applying brush strokes OR making the room look fresh
Locking a door	Putting a key in the lock OR securing the house
Voting	Influencing the election OR marking a ballot
Filling out a personality test	Answering questions OR revealing what you're like
Greeting someone	Saying hello OR showing friendliness
Taking a test	Showing one's knowledge OR answering questions
Resisting temptation	Saying "no" OR showing moral courage
Traveling by car	Following a map OR seeing countryside
Talking to a child	Teaching a child something OR using simple words

Study 2

Work on intertemporal choice has demonstrated that people will often prefer a smaller immediate gain relative to a larger gain later (e.g., Thaler, 1981). Even though the later award is larger, people sometimes discount it because it does not have the immediate satisfaction of an award received sooner. This temporal discounting can be overcome when construing the two choices at a relatively high level. High-level construals consist of more abstract representations that are less focused on low-level contextual details, such as positive affect from receiving an award immediately. Previous work has shown that high-level construals lead to less temporal discounting (Fujita et al., 2006). Having demonstrated that experienced verticality influences construal level, we next tested whether verticality also influenced intertemporal choice, which varies by construal level. We predicted that high, relative to low, verticality would lead to high-level construals as evidenced by reduced temporal discounting.

Method

After ascending or descending a staircase on a university campus and agreeing to volunteer for a survey, an experimenter blind to the hypothesis gave participants ($N = 33$) a sheet with 20 temporal discounting questions (e.g., Would you rather have $150 now, or $200 in one month?). Participants always chose between two amounts of money: the future amount (which would be received between one week and three years later) was always $200, and the immediate amount ranged between $50 and $150.

Results and Discussion

As predicted, participants who had ascended a staircase more often chose the larger amount of money in the future ($M = 62.19\%$, $SD = 10.32$) than those who descended the staircase ($M = 45.53\%$, $SD = 13.20$), $t(31) = 4.02$, $p < .001$, $r = .59$.

Simply walking up, relative to down, a flight of stairs led participants more often to forego less money now for more money later in hypothetical scenarios. Thus, across Studies 1 and 2, verticality influenced responses in two distinct domains linked only by their relationships to construal level. Both domains are consequential. Action identification level is relevant to self-control and goal pursuit (Fujita et al., 2006), and reduced temporal discounting is critical for saving money for the future, such as for retirement (Diamond & Köszegi, 2003). Experiences of high verticality caused people to process both domains in more meaningful ways.

Study 3

Studies 1 and 2 revealed that verticality influenced action identification level and temporal discounting as predicted by verticality's relationship with construal level. One possibility not yet examined is that high verticality might elicit positive mood, and low verticality might elicit negative mood, and the resulting moods might influence construal level. Indeed, high and low verticality is associated with positive and negative affect (Meier & Robinson, 2004; Crawford et al., 2006), and positive mood leads to more abstract processing (Gasper & Clore, 2002). It is then possible that verticality influences mood, which then influences construal level. We therefore examined whether verticality's influence on construal level was dependent on mood.

Study 3 also used a new dependent measure, category inclusiveness. High-level construals are linked to broader, more inclusive categorization (Isen & Daubman, 1984). A person exhibiting high category inclusiveness might consider *camel* to belong well to the category *vehicle*, even though it is a relatively weak exemplar (compared to *car* or *bike*). We predicted that high, relative to low, verticality would enhance category inclusiveness of weak exemplars, an indicator of high-level, broad construal of a category.

Method

After ascending or descending a flight of steps and agreeing to volunteer for a survey, participants ($N = 34$; 43% female, 57% male) were given the category-inclusiveness task by an experimenter blind to the experimental hypothesis. Similar to Isen and Daubman (1984), we chose strong, moderate, and weak exemplars using Rosch's (1975) norms. Participants received nine exemplars (three of each level of fit) per two categories: furniture and vehicle, for a total of 18 exemplars. Exemplars were blocked in their respective categories, with the order of exemplars within blocks (category) randomized (however, the first exemplar in each was strong, as in Isen & Daubman, 1984). Participants were asked how well each exemplar belonged to the category on a scale, ranging from 1 (*definitely does not belong*) to 10 (*definitely does belong*).

Subsequently, participants completed a self-report mood measure previously used in conjunction with this task (Smith & Trope, 2006; Slepian & Ambady, 2012). They first indicated their overall current mood (How do you feel right now?) on a scale of 1 (*very bad*) to 9 (*very good*) and then rated specific feelings (calm, concerned, content, disappointed, nervous, down, happy, joyful, nervous, relaxed, and tense) from 1 (*not at all*) to 9 (*extremely*).

Results and Discussion

As predicted, participants rated weak exemplars as belonging more to the provided category after ascending the steps ($M = 4.55$,

$SD = 1.51$) than after descending the steps ($M = 3.38$, $SD = 1.52$), $t(32) = 2.24$, $p = .03$, $r = .40$. Though we did not make predictions for other exemplars, we present the data for moderate and strong exemplars, which both did not differ significantly by condition, moderate: ($M_{ascending} = 8.40$, $SD = 0.94$; $M_{descending} = 8.50$, $SD = 1.03$), $t(32) = 0.29$, $p = .77$; strong: ($M_{ascending} = 9.78$, $SD = 0.04$; $M_{descending} = 9.99$, $SD = 0.51$), $t(32) = 1.62$, $p = .11$.

Participants did not differ in mood, ($M_{ascending} = 5.353$, $SD = 0.931$; $M_{descending} = 5.00$, $SD = 1.00$), $t(32) = 0.12$ $p = .90$, positive affect ($M_{ascending} = 5.059$, $SD = 0.929$; $M_{descending} = 5.00$, $SD = 1.027$), $t(32) = 0.48$, $p = .86$, or negative affect ($M_{ascending} = 2.044$, $SD = 1.115$; $M_{descending} = 2.319$, $SD = 1.289$), $t(32) = 0.66$ $p = .51$. And furthermore, the influence of verticality on inclusion of weak exemplars remained when controlling for positive affect, as determined by an analysis of covariance (ANCOVA) with positive affect as a covariate, $F(1, 31) = 4.87$, $p = .03$, $r = .37$.

In addition to influencing action identification level and temporal discounting, verticality influenced category inclusiveness of weak exemplars in this study, and this effect did not seem to depend on mood. Thus, high relative to low verticality caused people to more frequently perceive meaningful relationships between objects and categories—experiences of high verticality induced abstract thinking. Taken together, Studies 1 through 3 demonstrate that verticality influences outcomes related to construal level, and that this influence does not depend on changes in positive affect. In the remaining studies, we more closely examine the nature of the relationship between experiences of verticality and construal level.

Study 4

Study 4 served as a replication of Study 3, but with notable modifications to the procedure and design. First, Studies 1 through 3 were quasi-experimental designs. Participants were approached after ascending or descending a staircase. Although we believe these participants are not likely to vary systematically in most respects (the participants who descended, after all, once ascended to the higher level as well), they do differ on one variable, which is the self-initiated goal to ascend or descend. Perhaps this goal to ascend or descend is driving the observed effects in the earlier studies, rather than movement or experiences of verticality per se. In addition, although Study 3 suggested that the effects of verticality on construal level were not dependent on mood, there are three other important variables to consider: arousal, felt power, and perceptual scope. Perhaps ascending stairs in the previous studies increased arousal. Although we are not aware of any work that links arousal to construal level, a low motivational intensity (which shares some similarity to, but is distinct from, a low level of arousal) broadens conceptual categorization (Price & Harmon-Jones, 2010). Thus, if ascending, relative to descending, the stairs is mildly, as opposed to highly, arousing it could increase construal level through arousal, rather than the experience of verticality. To examine this possibility, we include a measure of arousal in Study 4.

Along the same lines, perhaps ascending the stairs leads to high construal level by leading to the experience of power. Prior work has linked verticality to power (Schubert, 2005). In that work, powerful groups were judged as powerful more quickly when high on a computer screen than when low, whereas powerless groups were judged as powerless more quickly when low on a computer screen. It is interesting to note that these effects only occur when verticality is manipulated within subjects, but they do not occur when verticality is manipulated between subjects (Lakens, Semin, & Foroni, 2011; see also Lakens, 2012). Because our manipulation is between subjects, this alternative explanation of power driving our effects is perhaps less likely, but we nonetheless included a measure of power in Study 4.

Finally, as discussed in the introduction, although we propose that an influence of verticality on construal level likely originates from the influence of perceptual scope on conceptual scope, we suggest that the formed sensorimotor metaphor will not actually retain this mechanism of influence. That is, although high verticality enables a vantage point for greater perceptual coherence, which is known to lead to greater conceptual coherence (including higher construal levels), repeated pairings of associations between verticality and construal level should lead to a sensorimotor metaphor that links the two more directly (i.e., independent of shifts in perceptual coherence). That is, according to the simulated sensorimotor metaphor model (Slepian, 2015; Slepian & Ambady, 2014), such a sensorimotor metaphor will link related sensorimotor activations (e.g., related to ascension) with related processing experiences (e.g., thinking at high construal levels), and this pairing will be responsible for bidirectional influences, independent of how the metaphor was formed. Thus, Study 4 examined the influence of verticality on construal level, while holding perceptual scope constant.

Method

As in Study 3, an experimenter blind to the experimental hypothesis recruited volunteers ($N = 40$; 62% female, 48% male) to participate in the study. Rather than approaching participants ascending or descending a staircase, however, the experimenter approached participants on the middle level of a library (where there was a floor above, and below, both with identical layouts). After agreeing to take part in the study, the experimenter said that the participant actually had to fill out the survey in a different location and then randomly placed the participant either in the high verticality condition or the low verticality condition. In the high verticality condition, participants were directed to a stairwell where they were to walk up the staircase to the upper level. In the low verticality condition, participants were directed to the same stairwell but were asked to walk down to the lower level. In both cases, the experimenter did not use any words related to verticality (e.g., "up" or "lower"), but rather gestured in the direction for participants to head toward per the assigned condition. Moreover, neither level of the library, nor the view when walking up or down the stairs in the stairwell, afforded different amounts of perceptual scope (i.e., the stairwell was completely enclosed within a vertical shaft), thereby controlling for perceptual scope (see Figure 1).

Subsequently, participants completed the widely used and validated picture-oriented Self Assessment Manikin (SAM; Bradley & Lang, 1994). Participants rated their mood, arousal, and power selecting how they felt on nine-point scales, with anchors set at 1 (*very unpleasant*) and 9 (*very pleasant*); 1 (*calm*) and 9 (*excited*); 1 (*very powerless*) and 9 (*very powerful*), with manikins representing odd-numbered scale points (see Bradley & Lang, 1994). This

Figure 1. Example stairwell image, illustrating how the use of a stairwell offers identical levels of perceptual scope whether ascending or descending the stairs.

instrument has successfully measured mood, arousal and power (sometimes labeled as dominance) in hundreds of articles, is valid for use across cultures (Morris, 1995) and ages (Backs, da Silva, & Han, 2005), and is the instrument used to measure affective norms for the popular International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1999).

Last, participants completed the category-inclusiveness task (from Study 3), but with two additional categories for a total of four categories: clothing, furniture, vehicle, and vegetable (see Table 2).

Results and Discussion

We first examined whether the verticality manipulation influenced mood, arousal, or power as measured by the SAM. The manipulation did not significantly influence any of these variables: mood ($M_{ascending}$ = 6.43, SD = 1.77; $M_{descending}$ = 6.70, SD = 1.95), $t(38) = 0.47$, $p = .65$; arousal ($M_{ascending}$ = 4.55, SD = 2.42; $M_{descending}$ = 5.20, SD = 1.94), $t(38) = 0.94$, $p = .36$; power ($M_{ascending}$ = 6.53, SD = 1.70; $M_{descending}$ = 5.90, SD = 1.68), $t(38) = 1.17$, $p = .25$.

We next examined whether, as in Study 3, verticality influenced ratings of weak exemplars, specifically. Participants rated weak exemplars as belonging more to the provided category after ascending the steps ($M = 4.96$, $SD = 1.50$) than after descending the steps ($M = 4.02$, $SD = 0.97$), $t(38) = 2.35$, $p = .02$, $r = .36$. Although we again did not make predictions for other exemplars, we present the data for moderate and strong exemplars. Participants rated moderate exemplars as belonging more to the provided category after ascending the steps ($M = 8.25$, $SD = 0.99$) than after descending the steps ($M = 7.42$, $SD = 0.97$), $t(38) = 2.69$, $p = .01$, $r = .40$; strong exemplars did not differ significantly by condition ($M_{ascending} = 9.85$, $SD = 0.31$; $M_{descending} = 9.80$, $SD = 0.37$), $t(32) = 0.39$, $p = .70$.

Last, we examined whether the predicted effect of ascending versus descending the stairs on weak exemplars held when controlling for influences upon mood, arousal and power. An ANCOVA with those three variables entered revealed that mood, $F(1, 35) = 0.34$, $p = .86$, arousal, $F(1, 35) = 0.89$, $p = .35$, and power, $F(1, 35) = 0.90$, $p = .35$, were not significant covariates, and the influence of ascending and descending remained, $F(1, 35) = 4.80$, $p = .035$, $r = .35$.

The first four studies demonstrated a link between experiences of verticality and construal level, across three distinct domains (action identification, monetary decision making, and categorization). In addition, these studies suggested that changes in mood, arousal, power and perceptual scope were not mediating mechanisms. Studies 3 and 4 measured mood, and Study 4 additionally measured arousal and power, and experiences of verticality did not differently influence these variables. That verticality did not influence felt power does not challenge the notion of a relationship between power and verticality (Schubert, 2005) but is consistent with recent work, which suggests that within-subject manipulations of verticality are necessary to achieve such effects (Lakens et al., 2011).

In addition, by randomly assigning participants to ascend or descend a staircase that did not offer different levels of perceptual scope whether ascending or descending, we demonstrate that the current results are also not specific to relatively high verticality giving greater perceptual scope. Instead, the experience of verticality itself can influence construal level, aligning with the current prediction that once a sensorimotor metaphor is formed between experiences of verticality and construal level, the original mediating link between the two is not necessary to find influences between the two (given that the neural ensembles involved in integrating sensorimotor maps and associative are not "content aware" of the instantiations being linked to sensorimotor processing; see Barsalou, 1999; Damasio, 1989).

Study 5

Although Studies 1 through 4 suggest that mood, arousal, felt power, and perceptual scope were not responsible for the influence of verticality on construal level, one additional possibility is that

Table 2
Exemplars and Categories Used in the Category Inclusiveness Tasks From Studies 3, 4, and 6

	Exemplars		
Category	Weak	Moderate	Strong
Clothing	Purse, ring, cane	Shoes, tuxedo, stockings	Shirt, pants, dress
Furniture	Stove, fan, telephone	Cabinet, stool, lamp	Chair, table, sofa
Vegetable	Pickles, seaweed, rice	Bean, potato, parsnip	Carrot, pea, green beans
Vehicle	Camel, feet, elevator	Bike, boat, jet	Car, truck, bus

experiences of verticality are linked to construal level through superficial semantic association. For example, perhaps participants semantically link the concept of *high* (which is activated by verticality) with the pursuit of "bigger" goals (e.g., preferring "more" money over "less" money), and verticality primarily influences construal level by this superficial semantic association. In Study 5, we tested this superficial semantic association account.

We also tested whether the effects of the manipulation used thus far (i.e., walking up/down stairs) on construal level depended on upward versus downward movement or whether simply being vertically high versus low would suffice. In Studies 1 through 4, construal level was influenced by movement upward and downward. Thus, it is possible that movement upward and downward primes "high" and "low" semantically and that participants link concepts of "high" and "low" with, for example in the case of temporal discounting, planning for the future or not (i.e., choosing "more" money for the future, rather than "less" money for now after semantic activations of "high"). In addition, it is possible that movement is necessary for these effects to occur, that only change in verticality influences construal level. We examined whether both movement (i.e., change in verticality) and superficial semantic association was responsible for influencing construal level in the domain of temporal discounting.

Method

Participants ($N = 73$) were approached in an atrium on a university campus in one of four conditions by an experimenter blind to hypotheses. In the atrium was a large staircase, where participants were approached after having just ascended or descended. This corresponds to the two conditions used in Studies 1 through 3. We also added two more conditions. In these conditions participants were approached while on the first level or the second level of the atrium (i.e., there was no recent change in verticality). Because of the layout of the atrium, participants on the first level saw an expansive area above them, including the second level. Likewise, participants on the second level saw an expansive area below them, including the first level, thus making experienced verticality salient without having had recent change in verticality.

After agreeing to volunteer for a survey, participants were given a word-stem task designed to measure semantic activation of "high" and "low" concepts. Four word-stems measured semantic activation of "high" (*high*, *above*, *top*, *up*), four measured "low" (*low*, *below*, *bottom*, *down*), and 12 could only be completed with control words. For instance, bott_ _ could be completed as "bottom" or "bottle." Subsequently, participants completed the same temporal discounting task from Study 2.

Results and Discussion

Semantic activation. A count was taken of the number of "high" word stems and "low" words stems completed. A mixed-design repeated-measures analysis of variance (ANOVA) was conducted with the number of word stems completed as the dependent measure, and with word-stem completion type (high vs. low) as a within-subjects factor, and vertical location (high vs. low) and whether participants recently changed location (recent change vs. no recent change) as between-subjects factors.

This analysis revealed no main effect of word-stem completion type, $F(1, 69) = 2.45$, $p = .12$, $r = .19$, indicating that there were no main differences, overall, in the number of verticality words completed for the high versus low word stems. Word-stem completion type did interact, however, with vertical location, $F(1, 69) = 10.16$, $p = .002$, $r = .36$, whereby participants who were vertically high (either with a recent change or no recent change in verticality) completed more word stems with "high" words ($M = 2.74$, $SD = 0.86$) than did those participants who were vertically low (either with a recent change or no recent change in verticality; $M = 2.02$, $SD = 0.95$), $t(71) = 3.33$, $p = .001$, $r = .37$.

Those who were vertically low (either with a recent change or no recent change in verticality) demonstrated a nonsignificant effect of completing more word stems with "low" words ($M = 2.31$, $SD = 0.96$) than those who were vertically high (either with a recent change or no recent change in verticality; $M = 1.90$, $SD = 1.04$), $t(71) = 1.71$, $p = .09$, $r = .20$. There was neither a Word-Stem Completion Type $\times$ Location-Change interaction, $F(1, 69) = 0.005$, $p = .95$, $r = .01$, nor a three-way interaction between word-stem completion type, vertical location, and location change, $F(1, 69) = 0.001$, $p = .98$, $r = .004$.

Thus, having recently ascended steps ($M = 2.47$, $SD = 0.80$) or already being on the second level ($M = 3.00$, $SD = 0.71$) seemed to promote activation of vertically "high" concepts, relative to those who recently descended the steps ($M = 1.88$, $SD = 0.78$) or were already on the first level ($M = 2.12$, $SD = 1.05$). Conversely, there was a trend for those who either recently descended steps ($M = 2.18$, $SD = 1.01$) or were already on the first level ($M = 2.40$, $SD = 0.96$) to have greater activation of vertically "low" concepts than those who recently ascended the steps ($M = 1.65$, $SD = 0.93$) or were already on the second level ($M = 2.67$, $SD = 1.00$; recall there was only the two-way interaction between location and word-stem type and not a three-way interaction among those with location change).

Temporal discounting. We conducted a 2 (Vertical Location; high, low) $\times$ 2 (Location Change; recent change vs. no recent change) ANOVA on temporal discounting scores, calculated as in Study 2. This revealed a main effect of vertical location, $F(1, 69) = 23.00$, $p < .0001$, $r = .50$, whereby those on the second level (either with a recent change or no recent change in verticality) more often chose the larger amount of money in the future ($M = 58.08\%$, $SD = 10.58$) than did those on the first level (either with a recent change or no recent change in verticality; $M = 46.31\%$, $SD = 9.57$). There was neither a main effect of location change, $F(1, 69) = 0.11$, $p = .74$, $r = .04$, nor an interaction between vertical location and location change, $F(1, 69) = 0.04$, $p = .85$, $r = .02$.

Thus, having recently ascended steps ($M = 58.24\%$, $SD = 11.85$) or being already on the second level ($M = 58.60\%$, $SD = 9.95$) led participants to choose more often the larger amount of money in the future than they did when they recently descended the steps ($M = 47.06\%$, $SD = 9.69$) or were already on the first level ($M = 45.80\%$, $SD = 9.65$; again, recall there was no interaction between location and location change).

Being verticality high, relative to low, influenced temporal discounting, and also seemed to lead to more semantic activation of "high" versus "low." We therefore next conducted a 2 (Vertical Location; high vs. low) $\times$ 2 (Location Change; recent change vs. no recent change) ANCOVA on temporal discounting scores with the inclusion of an index of relative "high" to "low" activation as the covariate (subtracting "low" activation from "high" activation).

This covariate was not significant, $F(1, 68) = 0.44$, $p = .52$, $r = .08$. In addition, the main effect of vertical location remained, $F(1, 68) = 21.99$, $p < .001$, $r = .49$. There was still neither a main effect of location change, $F(1, 68) = 0.10$, $p = .75$, $r = 04$, nor an interaction between vertical location and location change, $F(1, 68) = 0.04$, $p = .85$, $r = .02$. Thus, semantic activation did not predict temporal discounting. In sum, the influence of verticality does not seem to depend on change in verticality (i.e., vertical movement) nor depend on superficial semantic associations (whereby "high" and "low" are semantically linked to goals involving, for example, "more" vs. "less" money); the mere experience of verticality seems enough to induce these effects.

Study 6

To further isolate whether the experience of verticality influences construal level, in Study 6 we explored minimal experiences of verticality. That is, we presented images to participants that should lead to the experience of relative high or low verticality, and we then measured this resulting experience of verticality. For the same reason that simply imagining height can cause fear in someone afraid of heights, being exposed to upward and downward heights should evoke minimal experiences of low and high verticality (see Clerkin, Cody, Stefanucci, Proffitt, & Teachman, 2009). We predicted that photographs conveying high, relative to low, verticality would induce the experience of verticality and increase construal level as measured by category inclusiveness.

Method

Undergraduate participants ($N = 44$; 65% female, 35% male) completed the study for partial course credit, and experimenters were blind to hypotheses and experimental condition. Participants were randomly assigned to one of two conditions. In one condition, participants were exposed to 16 downward-angle photographs taken from high places (e.g., on top of a canyon or a staircase), presented on a computer screen, whereas in the other condition participants were shown 16 upward-angle photographs from down low (e.g., looking up at buildings or trees). They were asked how "How high/low does this picture make you feel?" from 1 (*extremely low*) to 7 (*extremely high*). Subsequently, they completed the category inclusiveness task (from Study 4, which measures how abstractly categories are construed) that included weak, moderate, and strong exemplars for four categories (see Table 2).

Results and Discussion

As predicted, participants who were exposed to the "high" photographs reported greater experiences of verticality ($M = 5.75$, $SD = 0.56$) than those exposed to the "low" photographs ($M = 2.98$, $SD = 0.66$), $t(37) = 14.11$, $p < .0001$, $r = .92$. In addition, those exposed to the "high" photographs rated weak exemplars as belonging more to the provided category ($M = 4.79$, $SD = 0.99$) than did those exposed to "low" photographs ($M = 3.87$, $SD = 0.89$), $t(37) = 2.98$, $p = .005$, $r = .44$. Though we again did not make predictions for other exemplars, we present the data for moderate and strong exemplars: Participants exposed to the "high" photographs also rated moderate exemplars as belonging more to the provided category ($M = 8.27$, $SD = 0.88$) than did those exposed to "low" photographs ($M = 7.35$, $SD = 1.26$), $t(37) = 2.68$, $p = .01$, $r = .40$, whereas strong ratings did not differ ($M_{\text{“high”}} = 9.44$, $SD = 0.87$; $M_{\text{“low”}} = 9.25$, $SD = 1.30$), $t(37) = 0.55$, $p = .58$.[2]

In Study 6, minimal experience of verticality influenced construal level. Across the prior studies, verticality influenced construal level along several domains: action identification, temporal discounting, and category inclusiveness. Furthermore, movement, superficial semantic links between verticality and dependent measures, mood, arousal, power, and perceptual scope were tested as mechanisms. The prior studies provided no evidence for the alternative mechanisms, and the present study suggests that even minimal experience of verticality is sufficient to influence construal level. Thus, experiences of high relative to low verticality were sufficient to cause people to perceive relationships between objects more frequently— experiences of high verticality induced abstract thinking.

Study 7

In Study 6, we demonstrated that the even minimal experience of verticality influenced category inclusiveness. In other words, Study 6 specifically isolated the manipulation of minimal experiences of verticality and still found an influence on construal level. This study, combined with Study 4, in particular, which held perceptual scope constant, provides strong support for an association between verticality and construal level and is evidence for the mechanism we propose (relative to alternative explanations that did not receive support in the prior studies). This is in alignment with the proposal of the current work, which is that independent of the origin for pairings between sensorimotor and processing experience, a sensorimotor metaphor can arise from those pairings with psychological consequences.

We proposed that given that greater perceptual scope can give rise to increased construal levels (Friedman et al., 2003) and high verticality enables greater perceptual scope, individuals might have experiences that link high verticality to high construal levels. These can come either through personal experiences with such conjoint activations or from exposure to the metaphor in daily life (and these processes mutually influence each other, with conjoint activations giving rise to the metaphor, and the metaphor giving rise to conjoint activations; see Slepian & Ambady, 2014). Studies 1 through 6 demonstrated that experiences of verticality, whether from ascension/descension, actual upward/downward visual angle, or depicted upward/downward visual angle, influences construal level across numerous domains, independent of perceptual coherence. Recent advances in metaphor research now make clear that sensorimotor metaphors can have bidirectional influences (e.g., Lee & Schwarz, 2012; Slepian & Ambady, 2014), thus the final study examined whether construal level could influence the verticality with which one takes a visual perspective.

Study 7 induced high-level and low-level construals by asking participants to either describe how they would pursue eight goals (low-level construals) or why they would pursue eight goals (high-level construals; adapted from Freitas, Gollwitzer, & Trope, 2004;

[2] One participant's Mahalanobis distance exceeded the critical value ($p < .05$), and was thus a bivariate outlier. This participant was therefore excluded. Including this participant does not alter statistical significance.

see also Fujita et al., 2006; Wegner & Vallacher, 1986). Subsequently, participants made a perceptual judgment designed to measure the verticality of visual perspective. Participants judged where a dot was located on a colored Necker Cube (see Figure 2). A Necker Cube (Necker, 1832) is ambiguous as to which orientation it is in. One can either make a judgment reflecting oneself as if looking down upon the cube (in which case the dot in the figure is in the back of the cube), or as looking up at the cube (in which case the dot is in the front of the cube). We reasoned that how one resolves this ambiguity should depend on the verticality of one's visual perspective. Individuals who take a vertically low visual perspective should judge the cube as if they were below it and therefore looking up at it. Individuals who take a vertically high visual perspective should judge the cube as if they were above it and therefore looking down on it. Perceivers tend to take a vertically high visual perspective when resolving the ambiguous Necker Cube, as if they are looking down on it (Sundareswara & Schrater, 2008). We predicted that prompting high-level construals would make participants more likely to take a vertically high visual perspective and, likewise, that low-level construals would make participants more likely to take a vertically low visual perspective, making the latter participants more likely to judge the cube as if they were below it and therefore looking up at it.

Method

Participants (N = 44; 32% female, 68% male; M_{age} = 37), recruited online (see Buhrmester, Kwang, & Gosling, 2011) were randomly assigned to describe how or why they would pursue eight goals (e.g., study for an important test, eat healthy). Subsequently, they were shown the image in Figure 2 and asked to indicate whether the dot was in the front of the cube or the back of the cube. The former would indicate taking a vertically low visual perspective (as if one was below the cube), and the latter would indicate taking a vertically high visual perspective (as if one was above the cube).

Results and Discussion

Participants who made low-level construals (i.e., who answered how questions) more often reported the perception that the dot was in the front of the cube (taking the vertically low visual perspective; 33.33%) than those who previously made high-level construals (i.e., who answered why questions; 8.70%), $\chi^2(1, N = 44) = 4.10$, $p = .04$, Cramér's $\varphi = .31$.

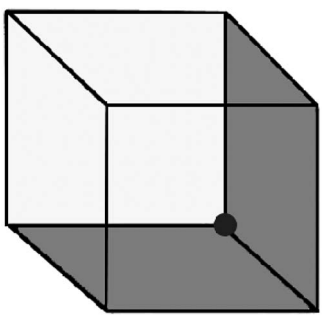

Figure 2. Necker Cube viewed by participates in Study 7. In the study, the dot was red, the lighter faces yellow, and darker faces blue.

Reflecting on abstract meanings (such as why people perform different behaviors) led participants to be more likely take a vertically high visual perspective, whereas reflecting on concrete processes (such as how people perform different behaviors) led participants to be more likely take a vertically low visual perspective. That is, participants who made low-level construals more often interpreted an ambiguous image as if perceiving it from below, and those who made high-level construals more often interpreted it as if perceiving it from above. It is important to note that the choice between "in front of" and "in back of" avoided terms such as "high" and "low", ruling out the possibility that low- and high-level construals (conveyed by how and why questions) influenced judgments as a function of semantics. In addition, the conditions did not differ in terms of perceptual scope, suggesting that the link between verticality and construal level is again independent of perceptual scope.

General Discussion

Across seven studies, we examined the relationship between experiences of verticality and abstract versus concrete processing. High, relative to low, verticality led to higher level identifications for actions (Study 1), greater willingness to delay short-term monetary gains for larger long-term monetary gains (Studies 2 and 5), and more frequent perceptions of meaningful relationships between objects and categories (Studies 3, 4, and 6). Thus, experiences of verticality, such as the simple act of ascending or descending a staircase, looking up or down, or perceiving depictions of high or low verticality, can influence construal level in numerous domains that have implications ranging from self-control (Diamond & Köszegi, 2003; Fujita et al., 2006; McCrea et al., 2008) to creativity (Isen & Daubman, 1984).

The studies thus demonstrate that several elements of experienced verticality—ascension/descension (Studies 1 – 4), actual upward/downward visual angle (Study 5), and mere depictions of upward/downward visual angle (Study 6)—can influence construal level, as predicted by the hypothesis that individuals' verticality-construal level sensorimotor metaphor would have important psychological consequences. In addition, we ruled out several mechanisms, including mood (Studies 3 and 4), power (Study 4), arousal (Study 4), perceptual scope (Study 4), and superficial semantic links between "high" and "low" and the dependent measures (Study 5). Furthermore, we provided evidence that even minimal experiences of verticality can influence construal level (Study 6), and conversely, construal level can influence the verticality of one's visual perspective (Study 7).

Independent of potential covariates like mood, power, arousal, and perceptual scope, elements of the experience of verticality can influence construal level. This aligns with our hypothesis that a sensorimotor metaphor that links verticality to construal level can have bidirectional influences. We propose that, initially, a link develops between verticality and construal level because relatively high verticality affords greater perceptual coherence, which enables greater conceptual coherence, or higher construal levels ("seeing the forest for the trees"). Given repeated pairings such as this, when one process is later experienced, the other should be promoted (i.e., verticality influences construal level outcomes, and

construal level influences verticality outcomes). Alternatively, one might acquire the verticality-construal level metaphor from exposure to the metaphor in daily life, or popular culture, as there are many such examples of people using this metaphor (e.g., see the opening examples about Martin Luther King, Jr.; Ralph Waldo Emerson; and Abraham Maslow). Acquiring this metaphor should also create links between construal level processes and sensorimotor processes related to experiences of verticality, leading to bidirectional influences between the two (see Slepian & Ambady, 2014).

By forming either a psychological link between sensorimotor experience and processing experience (through metaphor) or through direct pairings made during personal experience, connections between the two might be formed, allowing for mutual influences (Barsalou, 1999; Lee & Schwarz, 2012; Slepian & Ambady, 2014). Indeed, metaphors should be nearly as potent, if not equally potent, as actual experience in terms of promoting neural links given that merely conceiving of sensorimotor states can lead to simulations of those states (Belardinelli et al., 2009). Therefore, employing a metaphor about some state will lead to sensorimotor activations related to that state. Diverse aspects of cortical representations can integrate such sensorimotor processing with associative areas via bidirectional links; thus the two can become intimately linked, mutually influencing each other (Slepian & Ambady, 2014).

One point we suggest, not previously explored in extant literature, is that such a process creates a new connection between sensorimotor and processing experience and that one can influence the other independent of original links. Indeed, in Study 4, participants ascended or descended stairs, which influenced construal level, but this could not be attributed to high (vs. low) verticality affording greater perceptual scope as the layout of the stairwell offered identical views regardless of whether one was ascending or descending the stairs. Thus, although the link between verticality and construal level might be initially linked via perceptual scope (Friedman et al., 2003), new links between the two might be formed (via sensorimotor metaphor) independent of perceptual scope. The current findings thus suggest a new role for sensorimotor metaphor in providing connections between sensorimotor experience and cognition, potentially forming new links that build from prior experience, but then can exist independent of that initial experience.

Moreover, the current work expands on prior work examining the grounding of concepts by examining the grounding of processing style (cf. Slepian & Ambady, 2012; Slepian, Weisbuch, Pauker, Bastian, & Ambady, 2014; Zarkadi & Schnall, 2013). That is, prior models of grounded cognition have focused on the ways in which concepts can be grounded within the sensorimotor system. Yet, the current models that explain these grounding processes make clear that the mechanisms that allow for such grounding are not "content aware" of the instantiations being linked to sensorimotor processing. In other words, through the same mechanisms by which neural ensembles create higher order bidirectional links between conceptual processing of a concept and physical experience with a concept, as stated in current theory, higher order links between processing styles and sensorimotor activity should also be created. No work has examined this possibility, however, which was one goal of the current work. The current work indeed demonstrated a link between verticality and construal level, which we suggested originates from a shared relationship with perceptual scope, but through the mechanisms outlined in preceding paragraphs, can then extend beyond that original relationship. The finding of a sensorimotor-to-construal-level link brings a number of implications given that one's construal level can change how one construes any object, event, or person.

Construal Level and Psychological Distance

Verticality and psychological distance. Construal level theory (Trope & Liberman, 2010) posits that abstract versus concrete thinking is determined in large part by psychological distance. If an event is psychologically far, an abstract construal is favored; if it is psychologically close, a concrete construal is favored. Thus, events that are far away in one of the four dimensions of psychological distance (temporal, spatial, social, and hypothetical) are conceived of in relatively abstract terms, while events that are psychologically near are conceived of in relatively concrete terms.

In the current work, verticality influenced construal level in multiple domains, such as action identification, intertemporal choice, and categorization. One possibility is that verticality led to outcomes of higher construal levels because verticality is another dimension of psychological distance. What is up high might be more distant than what is down low. However, this explanation seems unlikely because the self is not anchored to any end of the vertical spectrum as it is with other psychological distance dimensions. With spatial and temporal distance, for example, the self is always here and now, and external objects might move progressively further away. The yoking of the self to "near" is a crucial element of construal level theory (Trope & Liberman, 2010). In contrast, the self is neither always high nor always low. Objects can be both far above the self, such as the top of a building when on the ground, and far below the self, such as the ground when looking down into a valley or simply looking out a window when on an upper floor of a building. Thus, unlike with space and time dimensions, no end of the verticality dimension is yoked to the self, making a psychological distance account of the current results unlikely. Moreover, it is difficult to explain how ascending or descending an identical staircase, for example, would evoke different levels of psychological distance given that the same spatial distance is traveled in both cases.

High construal levels make people, events, and objects seem psychologically far, whereas low construal levels make people, events, and objects seem psychologically close. There seems to be poor alignment between psychological distance and verticality given that psychological distance is necessarily yoked to the self in construal level theory, but not to verticality. Still, however, one could propose that because high verticality can allow one to see farther into spatial distance, perhaps high verticality evokes high construal levels by implicitly reminding one of far spatial distance. Yet this alternative explanation also falls prey to the problem that verticality does not align well with spatial distance. Consider, for example, looking upward at a tall skyscraper (used as a manipulation of low verticality). Here one feels far away from the top of a building and thus is taking the spatially distant, "long view," perhaps even marveling at the distance to top of the skyscraper, but this experience makes one

feels vertically low (not high; i.e., a vertically low and spatially distant congruence).

In the final study, construal level influenced judgments of perceptual ambiguity along vertical space, with low, relative to high, construal levels leading perceivers to take the visual perspective of low verticality. The final study, in particular, makes a psychological distance account of the present effects unlikely as there is no reason to suspect psychological distance to influence whether a Necker cube is perceived as if from above or below it.[3]

Bidirectional influences: Commonalities and differences. Although the current results do not seem to be a function of psychological distance, they have numerous implications for psychological distance given psychological distance's bidirectional relationship with construal level. For instance, high verticality might prompt psychological distance as a function of evoking high, relative to low, construal levels. Ascending a staircase or looking out on a balcony might lead to high-level construals, consequently leading one to feel more socially distant from others, that a certain event or outcome is less likely to happen, or that an upcoming responsibility is still quite far away. Conversely, walking down a staircase might lead one to think a gamble is more likely to pay off or looking up at a tall sculpture might make on feel closer to a fellow onlooker.

Thus, verticality might have influences on psychological distance because of its shared relationship with construal level. Although both verticality and psychological distance share respective bidirectional relationships with construal level, the nature of those bidirectional links are quite different. For example, according to construal level theory (Trope & Liberman, 2010), people traverse psychological distances via mental construal processes. To think of an object that is far away (from the self) in spatial, temporal, social, or hypothetical dimensions, one must think of that object in more abstract ways. Reciprocally, by adopting such an abstract processing style, it allows one to expand the psychological distance at which one can construe an object. Thus, according to construal level theory, the nature of the bidirectional relationship between construal level and psychological distance is one of functionality. The function of abstract construals is that they allow one to traverse psychological distance to obtain distal perspectives. Without abstract thought, one would not be able to conceive of faraway events or ideas. Conversely, by considering a distal idea or perspective, one is necessarily construing it in an abstract manner.

Verticality's bidirectional relationship with construal level does not seem to share such a direct, functional link. That is, abstract thinking does not function to enable processing of vertically high events or ideas. Unlike vertically high events or ideas, psychologically distant events or ideas (those in the future, those in some faraway place, etc.) are difficult or impossible to see or feel and so must be processed in abstract ways. Thus, unlike with psychological distance, construal level is not essential to the processing of events and ideas along the vertical dimension. Nor do we suggest that the function of verticality is to afford high-construal levels, at least not directly. Verticality is instead often used to organize objects in space. Verticality can also be used to obtain an expanded perceptual scope. Indeed, we suggest a link initially develops between verticality and construal level from both sharing a relationship with perceptual scope. We suggest moreover that this link can then exist beyond that initial relationship. That is, because of repeated pairings between the two, and following mechanisms outlined by theories of grounded cognition (Barsalou, 1999, 2008; Lakoff & Johnson, 1980, 1999), we suggest a new link can be made that transcends the original indirect link, allowing for bidirectional influences between the two. Thus, although the link between psychological distance and construal level seems superficially similar to the link between verticality and construal level, the nature of these links seem quite different.

Content and process. The vertical spatial dimension has been demonstrated to influence cognition in the domains of power, morality, virtue, and affect among other domains (see Landau, Meier, & Keefer, 2010). It perhaps makes sense that such an omnipresent element of experience has been used to provide conceptual coherence across a range of concepts. Because of gravity, the vertical dimension in space is indeed present in every moment of one's experience. Thus, when something accumulates it tends to accumulate upward. Although experimental work has only in the past decade begun to detail how this spatial experience provides coherence to a number of abstract concepts, the idea that sensorimotor experience can provide the foundation for more advanced cognition is not new. As discussed by Meier and Robinson (2004); Piaget and Inhelder (1969) provided this hypothesis more than 40 years ago. They suggested that the primary way in which young children interact with their world in early development is through the senses of touch, taste, smell, audition, and vision. With age, children develop more advanced and abstract cognition and reasoning, but this is built upon earlier sensorimotor experiences. As suggested by work in concept acquisition, an information processing system might be attuned to detecting regularities across sensory and conceptual processing (Mandler, 1992). Discovering these regularities involves discovering and making metaphorical mappings between concrete sensations and abstract concepts (Lakoff & Johnson, 1980; Williams, Huang, & Bargh, 2009). When people are happy or healthy, their posture is erect (i.e., vertically high); when people are sad or sick, their posture is slumped or weak (i.e., vertically low). Indeed, when induced to have an upright, relative to a slumped-down, body posture, after receiving positive feedback participants felt more pride (Stepper & Strack, 1993). Thus, it makes sense that people develop and agree on metaphors like "happy is up" and "sad is down," or "virtue is up" and "depravity is down."

Unlike prior work, which demonstrates how verticality can provide conceptual coherence across a number of concepts, such as the conceptual content of affect, morality, and power, the current work examines another aspect of verticality, a processing style it can actuate. That is, not only does verticality influence the content of one's cognition (in line with conceptual metaphors), but it also influences how one processes that conceptual content; that is, how any object, person, or event is construed. High-level construals promote abstract thinking and an awareness of superordinate re-

[3] Even if, for example, high-level construals led to a spatially distant view of the cube, given its ambiguity along vertical space, horizontal spatial distance would not influence how its verticality would be viewed (cf. Kubovy, 1986).

lationships, whereas low-level construals induce a focus on more concrete details. The level of construal adopted has a pervasive influence on visual perception, categorization, action identification, and person perception, among other domains (see Trope & Liberman, 2010); therefore verticality, experienced whenever looking out a window when on a upper floor of a building, walking up a staircase, or simply looking upward at a tall building, should influence cognition in a variety of domains, ranging from how another is perceived to whether goal pursuit is successful to the creativity of produced work.

Construal Level and Other Correlates

Affect. As discussed earlier, psychological distance correlates with construal level, but it is unlikely that it mediates the link between verticality and construal level. Another possible mediator explored in the present work was that of affect. The affect-as-information theory (Schwarz, 1990, 2002; Schwarz & Bless, 1992) proposes that current positive feelings can signal a safe environment, thereby cuing top-down processing styles that are global and holistic, and promote creative (and thus potentially risky) problem solving. Alternatively, negative feelings can signal an unsafe environment, thereby cuing bottom-up processing styles that are local and systematic and foster more analytical problem solving. Thus, from this perspective, positive affect can lead to abstract processing styles, and negative affect can lead to concrete processing styles (cf. Gable & Harmon-Jones, 2008, 2010a, 2010b).

Given that conceptual metaphors link concepts of positive affect with high verticality and negative affect with low verticality, it is possible that affect mediates the verticality-construal level link. However, we measured both general mood, and positive and negative affect in Studies 3 and 4 and found no evidence that mood or affect mediated the verticality-construal level link.

Alternatively, it is possible that the process of evaluating items positively and negatively (rather than affect itself) is associated with verticality and explains the verticality-construal level link. That is, rather than people feeling positive or negative affect themselves, they might be evaluating objects outside of themselves positively or negatively when high or low, and those positive and negative evaluations might inspire abstract and concrete thinking, respectively. This explanation would require two links.

First, it would require a link between evaluation and verticality, such that high and low positions are associated with positive and negative evaluations. However, it is not clear that such a link exists. Although it is possible to describe work demonstrating links between affect and verticality as between evaluative processes and verticality, we suggest that such descriptions cannot ignore the corollary content behind such evaluative processes. That is, evidence of people evaluating objects quickly as "good" or "bad" (e.g., Meier & Robinson, 2004) could simply be a function of people exhibiting high salience of "good" and "bad" concepts.

Second, it would require abstract and concrete thinking to be linked to positive and negative evaluations, respectively. Some work, which suggests that negative affect produces concrete thinking (Wegner & Vallacher, 1986), is consistent with that idea. However, that work looks specifically at affect, not at evaluation of objects. In contrast, there is ample work suggesting the opposite of this relationship. That is, there is a rich literature demonstrating that negative evaluations and emotions are linked to abstract (not concrete) construals (Watkins, Moberly, & Moulds, 2008). Indeed, excessive why-type thinking (i.e., high-construal thinking) is a major contributor to overly negative thought patterns and depressive states (e.g., Roberts, Gilboa, & Gotlib, 1998; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). On the other hand, a focus on concrete experiences (e.g., as in mindfulness training) has been linked to positive thoughts, evaluations, and outcomes (e.g., Mantzios & Wilson, 2014), suggesting no clear concrete–negative or abstract–positive links, given that both positive and negative affect and evaluations seem linked to concrete as well as abstract processing. Therefore, it seems unlikely that the verticality-construal link is explained via shifts in evaluation.[4]

An intriguing future direction for this research could be to explore not how verticality influences affective experience but instead how verticality changes the influence of affect on cognition. Perhaps by high verticality prompting abstract thinking, which relies less on current contextual details and affective states (Trope & Liberman, 2010; see also Ledgerwood, Trope, & Liberman, 2010), it could weaken the influence of affect on cognition. Conversely, low verticality might strengthen the influence of affect on cognition by promoting concrete processing styles that are more swayed by the influence of local and contextual affective states. Perhaps an even more intriguing possibility is that experiences of high, relative to low, verticality could diminish the influence of additional sensorimotor influences upon cognition and behavior. Maglio and Trope (2012) demonstrated that prompting high, relative to low, construal levels reduced the effect of sensorimotor states on cognition, leading, for example, felt heaviness to be less likely to lead one to rate an issue as more important (which normally increases importance ratings; Ackerman, Nocera, & Bargh, 2010; Jostmann, Lakens, & Schubert, 2009). Sensorimotor experiences of high, relative to low, verticality might promote an abstract processing style and thereby reduce further sensorimotor influences on cognition that might rely more upon concrete processing.

Power. To examine another domain, while the present results do not seem to be a function of power, they nonetheless present interesting implications for power. Prior work has demonstrated that those who have power make higher level construals, thinking more abstractly than do those with less power (Smith & Trope,

[4] To further explore the evaluative process hypothesis, we randomly assigned 40 Mechanical Turk participants to one of two conditions. In one condition, they were asked which activity they liked more, "walking upstairs," (coded as +1) or "waking downstairs" (coded as −1). In the other condition, they were asked which activity they disliked more. Positive scores indicate choosing walking upstairs, and negative scores indicate choosing walking downstairs. When asked which activity they liked more, participants preferred walking downstairs ($M = -.58$, $SD = .83$); and when asked which activity they disliked more, participants indicated that it was walking upstairs ($M = .71$, $SD = .72$), and these means significantly differed, $t(38) = 5.26$, $p < .00001$, $r = .70$. Individually, comparing each condition's mean to zero (no preference), both of these means differed significantly from zero: liking walking downstairs, $t(18) = 3.01$, $p = .007$, $r = .58$; disliking walking upstairs, $t(20) = 4.56$, $p = .0002$, $r = .71$. Thus, it is highly unlikely that walking upstairs increased construal level through positive evaluations, and walking downstairs decreased construal level through negative evaluations given that participants negatively evaluate walking upstairs and positively evaluate walking downstairs.

2006). It was proposed that this is an outcome dependent on psychological distance; those in power have greater psychological distance from others, such as those lower in the hierarchy (for a review of this social distance theory of power; see Magee & Smith, 2013). Yet, when people are in positions of power, they can also be "higher" in the hierarchy (cf. Magee & Galinsky, 2008). Indeed, there is a correspondence between power and verticality (Schubert, 2005) albeit only in certain contexts (Lakens et al., 2011). Given the coupling of verticality and construal level demonstrated in the present work, it is possible that power promotes higher construal levels not only as a function of psychological distance but also as a consequence of verticality. Power thus presents an interesting case for future investigations of the relationship between verticality, construal level, and psychological distance.

Mindsets. This work also promises interesting insights to complementary literatures on mental construal. That is, perhaps verticality operates similar to other sources that shift processing styles (see Schwarz, 2000). For example, Schwarz and Bless's (1992) inclusion/exclusion model suggests that a high-level, global processing style leads to a more inclusive mindset, whereby two objects are more likely to be categorized as belonging to the same category, and thereby promoting assimilation. In contrast, taking a low-level, local processing style leads to a more exclusive mindset, whereby two objects are more likely to be categorized as belonging to different categories, and thereby promoting contrast (see also Bless & Schwarz, 2010). Thus, by influencing construal level, verticality may have an effect on other cognitive processing styles, such as inclusive or exclusive mindsets, which can then subsequently influence assimilative and contrastive cognitions and behavior.

In addition, the current work might speak to other models of social cognition, such as the reflective-impulsive model (Strack & Deutsch, 2004). This model of self-control suggests that a stimulus and an immediate reactive impulse, such as reaching for unhealthy food, through repeated pairings, can lead to a strong association between the stimulus and the impulse. To overcome these impulses (when they are strong), a reflective, rule-based system is required but it operates more slowly and is more effortful, relative to the impulsive system. High-construal level prompted by high verticality might enable greater self-control through highlighting global value-relevant features of one's goals, thereby prompting the reflective system to overtake the impulsive system. Indeed, Studies 2 and 5 suggest that high verticality might enable people to delay short-term gains for larger long-term gains. Perhaps through the mechanisms outlined in control models like the reflective-impulsive model, abstract construals evoked by high verticality can enable greater self-control (see also Fujita & Carnevale, 2012).

Transcendence. Self-transcendence includes putting society before oneself, considering future generations rather than present needs, and seeking out universal meaning in life (Grouzet et al., 2005). Peak experiences in life are among the most fulfilling (Maslow, 1968), whether they be spiritual epiphanies, awe, or creative insights (Thrash, Elliot, Maruskin, & Cassidy, 2010). To self-transcend one must think more abstractly, focusing less on low-level details and more on high-level constructs. Peak experiences, which represent achievements metaphorically along vertical space, clearly indicate high-level construals: To be in awe or to have an epiphany or creative insight is to consider the high-level, abstract, superordinate relationships between and among entities. That transcendence captures both verticality and abstract, high-level thought illustrates the link between these two constructs. Many are familiar with the experience of a breathtaking view from high above and the transcendent feeling it evokes. Life's lower-level concerns seem less important and one can sense greater meaning and coherence for one's self-concept and life pursuits. And indeed, the influence of verticality upon construal level was demonstrated in numerous studies focusing on action identification, choice, and categorization. Future research might discover that not only can conceptual coherence be achieved by high verticality but perhaps high verticality can evoke coherence in life meaning—transcendence, greater insight, and abstract meaning in one's life.

Conclusion

When people experience relatively high verticality, they process information in more abstract ways; when people experience relatively low verticality, they process information in more concrete ways. Indeed, the link between verticality and construal level was consistent across a number of manipulations and influenced a diverse number of outcomes. The reverse relationship was also found: Engaging in abstract, relative to concrete, information processing induced high, relative to low, visual perspective, respectively. Therefore, experiences of verticality—which are ubiquitous, whether walking up or down a flight of steps, standing atop a hill, looking out a window, or admiring a large monument or building from below—has close links to the way in which people construe the world around them.

An ability to switch flexibly between concrete and abstract levels of information processing is crucial for responding to the diverse challenges of everyday life. When people are executing difficult actions, a focus on concrete details helps maintain attention and keep a steady hand (e.g., Schmeichel et al., 2011; Vallacher & Wegner, 1987). When people are making complex decisions or pursuing long-term goals, reflecting abstractly on the big picture helps them adhere to their values and beliefs (e.g., Fujita et al., 2006). The current work suggests that experiences of verticality facilitate the switch between these types of information processing.

More broadly, the present work revealed that sensorimotor experiences can be linked to information processing styles. A growing body of work has found numerous links between sensorimotor experiences and the content of people's cognitive processes (Barsalou, 2008; Landau et al., 2010). That is, prior work demonstrates that the concepts we hold can be tied to the physical experiences we have with such concepts. The present studies revealed that not only what people think but how they process information is tied to sensorimotor experience. People can process information in diverse ways, such as by deliberating carefully versus going with their intuition, focusing on themselves versus attending to their relationships with others, or focusing on specifics versus attending to the big picture. The latter type of thinking, as observed in the current work, is linked to and can be affected by experiences of verticality. Sensorimotor experiences can therefore inform how the mind processes information, with implications for goal pursuit, creativity, and attainment of transcendent, high-level, abstract thought.

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