The psychological status of image schemas

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Abstract

Cognitive linguists have proposed that image schemas underlie significant aspects of language and thought. Image schemas are generally understood as "experiential gestalts" that arise from recurring patterns of embodied experience (e.g., BALANCE, CONTAINMENT, SOURCE-PATH-GOAL). In earlier work I argued that there is significant empirical evidence from cognitive and developmental psychology to suggest that image schemas are "psychologically real" (Gibbs and Colston 1995). My aim in this chapter is to consider in greater detail the issue of whether image schemas are enduring mental representations, or better understood as temporary linkages between sensory experience and short-lived conceptualizations of both concrete events and abstract ideas. Under the later view, image schemas are not "representational structures" that provide the causal basis for thought and language, but are emergent, fleeting entities that are part of the embodied simulations used in online thought, including abstract reasoning. Research from cognitive psychology, developmental psychology, psycholinguistics, and cognitive neuroscience will be discussed in relation to cognitive linguistic observations about image schemas and image-schematic processing.

Keywords: image schemas, image-schematic processing, mental representations, embodied simulations in on-line thought

1. Introduction

Image schemas represent the essential glue that binds embodied experience, thought, and language. Since the 1980s, cognitive linguists, most prominently, have demonstrated through different case studies how image schemas play a critical role in describing a wide variety of linguistic structure and behavior. The impetus for cognitive linguists' discovery of image schemas is their discipline's commitment to study the formal structures of language

> … not as if they were autonomous, but as reflections of general conceptual organization, categorization principles, processing mechanisms, and experiential and environmental influences. (Geeraerts 1990: 1).

But what are image schemas? There is a large range of responses cognitive linguists give in reply to this question. I recently attended a conference on empirical methods in cognitive linguistics at Cornell University where the closing session was devoted to the issue of defining image schemas, and there was little consensus as to what these things were and how they functioned in linguistic structure and behavior. Moreover, there was much disagreement over the best methods that might be employed to uncover the structure and functions of image schemas. The present volume should provide an important forum for open discussion of these matters. As I now write, before seeing all of the other chapters to be included in this volume, my guess is that there will still be a fair amount of disparity over the nature and functions of image schemas in cognitive linguistic theory.

My general aim in this chapter is to update some of the relevant findings from psychology, and cognitive science more generally, on the psychological status of image schemas. Cognitive linguistic research surely provides evidence on the cognitive nature of image schemas. But I wish to defend the possibility that image schemas are also psychologically real, in the sense of playing a critical role in people's real-time thought and linguistic processes. Beyond this, I have a more specific goal of trying to recapture the experiential nature of image schemas, and to provide an important corrective to the trend in cognitive linguistics to conceive of image schemas as explicit kinds of abstract mental representations.

Ten years ago, Herbert Colston and I published a lengthy paper in the journal "Cognitive Linguistics" that offered a range of empirical evidence from cognitive psychology, psycholinguistics, and developmental psychology that appeared, in our view, to be entirely consistent with the possibility that image schemas underlie significant aspects of language and thought, enough so as to strongly argue that image schemas were indeed psychological entities and not just mere linguistic fictions (Gibbs and Colston 1995). We concluded the article with a note of warning that serves as the starting point for my argument in this chapter. We suggested

> … that linguists and psychologists be cautious in making concrete claims about how and where image schemas might be mentally represented. It is even possible that image schemas are not specific properties of the mind but reflect experiential gestalts that never get encoded as explicit mental representations. A different possibility is that image schemas might be

> characterized as emergent properties of our ordinary conceptual systems and therefore are not explicitly represented in any specific part of the mind. (Gibbs and Colston 1995: 370)

Despite this warning, most of the literature on image schemas implicitly assumes that these entities are encoded as explicit abstract mental representations in long-term memory, and serve as the enduring foundation for abstract concepts and different aspects of linguistic meaning. I strongly agree with the claim that image schemas are essential aspects of thought and language, but believe that image schemas are best understood as experiential gestalts which momentarily emerge from ongoing brain, body, and world interactions. Image-schematic reasoning, such as that seen in linguistic understanding, involves the embodied simulation of events, and is not simply a matter of activating pre-existing representational entities. Image-schematic reasoning does not simply mean doing something with one's mind, but constructing a simulation of experience using one's body.

2. Body schemas and image schemas

Image-schemas have traditionally been defined as dynamic analog mental representations of spatial relations and movements in space. Even though image schemas are derived from perceptual and motor processes, they are not themselves sensorimotor processes (Johnson 1987). The abstract nature of image schemas, given their emergence from recurring aspects of bodily experience, has unfortunately led cognitive linguists to talk of image schemas in a too static and disembodied way.

For example, image schemas are frequently employed in the analysis of spatial meanings of prepositions by demonstrating how topographic relationships are used to conceptualize more abstract domains (e.g., how SOURCE-PATH-GOAL provides a concrete topographic representation for an abstract expression such as *The premier wants his industrial relations minister to hack his way through the state bureaucracy* (Lee 2001: 41). In this manner, the basic "schema is strongly activated in producing the relevant meaning" and is represented as part of the "semantic network" associated with a preposition like *through* (Lee 2001: 48-49). Even if our understanding grows from basic sensorimotor knowledge and experience, the ultimate representation of image-schematic meaning is characterized as activation within some network that is abstracted away from experience.

My argument is that image-schematic reasoning is always being recreated by the body as people continue to engage in sensorimotor behaviors related to BALANCE, RESISTENCE, SOURCE-PATH-GOAL, CONTAINMENT, and so on. Understanding this point requires paying greater attention to the phenomenology of the human body in action. A key point here is that bodily schemas do not just give rise to image schemas, but that image schemas – including more static schemas such as OBJECT, or COMPLEXITY and COMPACTNESS – are continually tied to embodied action and simulations of experience.

Consider, for a moment, the idea of "body schema." Body schemas underlie how the body actively integrates its posture and position in the environment (Gallagher 1995). We do not ordinarily sense our bodies making postural adjustments as we perceive objects, events, and move about in the world. Body schemas allow us to adroitly walk without bumping into or tripping over things, to follow and locate objects, to perceive shape, distance, duration, and to catch a ball with accuracy. These mundane events all take place independently of our conscious thoughts of the body.

The ongoing operation of body schemas is significantly regulated by our proprioceptive system. Proprioception, often referred to as the "sixth sense," is neglected as an important embodied system, because it is not traditionally seen as an input system for presenting the world to the mind. The information proprioception provides comes from the nerve endings in muscles and joints, and partly also from those in the skin. The balance organ in the ear also contributes to the information about one's posture and position in space. Nerve endings in the muscles give information about the amount and fluctuation of muscle tone and the length and tension of the muscles and in doing so also gives information about movement and the amount of force used. Nerve endings in the joints give information about movement and position of the joints, and thus about movement and posture. Stretch receptors in the skin, especially in the face, give information about facial expressions and movement in speech and eating. The balance organ, together with information from the neck muscles, gives information about the body's global posture and position with respect to the horizontal plane.

Proprioception functions automatically, unconsciously, and may even operate when the brain is disconnected from the nervous system. All our movements and also the maintenance of a posture require a subtle coordination of countless muscles and joints that make up our body schema. Without immediate feedback from the sensory nerves about what the muscles and joints are doing, all of our movements and even the maintenance of our posture would go totally awry. The body schema provides the continually up-

dated, non-conceptual, non-conscious information about the body necessary for the execution of both our gross motor programs and their fine tuning.

Take, for example, a simple bodily action like standing up straight. We have known how to stand up since late infancy, and we no longer have to bother consciously with the appropriate motor programs we have at our disposal to perform this action. Also, the fine tuning of this posture is provided for by the body schema. If our arms are slightly in front of the body, we have to lean back somewhat to compensate for the extra weight in front. If we carry something in front of us, we have to compensate more. The compensating just happens; we don't have to think about it. We don't even notice these small corrections, not in others and not in our own case. It is only when we see people with very large beer-bellies or pregnant women that we notice that we are leaning backwards. All that information from the nerve endings in muscles and joints together with the information from the balance organ is needed. The body schema has to feed it in time to the motor program, otherwise we would fall over. But we don't have to be bothered with it. It all happens automatically, so that we have our hands literally free for other things.

Standing up straight is a recurring body experience, regulated by various body schemas, that is fundamental to a variety of image schemas, such as VERTICALITY, STRAIGHT, and BALANCE. However, the fact that image schemas may arise, or emerge, from recurring patterns of bodily experience does not mean that once they have emerged, they are then divorced from the ongoing functioning of body schemas. Different body schemas, such as those involved in standing up straight, continue to invigorate, and sustain, image schemas, like BALANCE, over the course of one's lifetime. Image-schematic reasoning continually recruits sensorimotor processes that are critical to how we understand ourselves, other people, and the world around us. In this way, image schemas are as much created in the moment, even in the absence of bodily movement, as they are retrieved from long-term memory. This perspective on image-schematic reasoning suggests that many aspects of perception, cognition, and language use are intimately tied to both real and imagined bodily action. There are several lines of evidence from cognitive science that are consistent with this idea (Gibbs 2005).

For example, one of the most important developments in cognitive science over the last 10 years is the discovery of "mirror neurons" in the frontal lobes of humans, and other primates. Mirror neurons are specialized brain cells that show activity both when a person performs an action and when it observes the same action performed by another (possibly cospecific) indi-

vidual. Research has demonstrated that mirror neurons are activated when individuals watch others perform bodily movement, observe others feeling pain and different emotions, hear voices and music, and see gestures (Stamenov and Gallese 2002). Other studies show that visual perception is rooted in both real and anticipated bodily movement, called "sensorimotor contingencies" (O'Regan and Noe 2001), and that speech perception is accomplished partly through the activation of the motor programs involved in speech production (Liberman and Mattingly 1985). Although cognitive scientists continue to debate these findings and their implications, there is an important trend in the literature to view many aspects of perception as being fundamentally coupled with action. A significant part of how we understand the behaviors of others is accomplished through real and simulated body actions, sometimes described in terms of "as-if body" loops (Damasio 1999, 2003).

3. Image schemas as embodied simulations

The processes by which we understand other's actions through concurrently activated "as-if body" loops is consistent with the idea that we understand others' thoughts by pretending to be in their "mental shoes" and by using our own mind/body as a model for the minds of others (Davis and Stone 1995).

Image-schematic reasoning may also depend on the embodied simulations created in different circumstances, such as listening to speech, that are part of "as-if body" loops. A critical part of this argument depends on a very specific view of what constitutes a simulation. Most scientists engaged in creating simulations of physical and behavioral processes do so by modeling the formal characteristics of those behaviors. Consider a meteorologist creating a computer simulation of the path of a hurricane along the eastern seaboard of the United States. This simulation nicely maps various topological relationships of this weather system and may even be used to predict the behavior of real hurricanes. To some extent, computer simulations of cognitive processes are similar to the meteorologist's simulations of the behavior of hurricanes – they capture relevant information about the formal characteristics of a set of operations that are carried out on particular representations.

But my claim that image schemas are embodied simulations is based on the idea of an actual "simulator" (Berthoz 2000). Unlike a computer simulation of behavior (e.g., neural networks or any symbolic computing device), a simulator provides something close to what it actually feels like in a full-

bodied manner to, say, fly an aircraft in a flight simulator where one feels all the movements associated with flying a real airplane. Image schemas, under this view, are simulators of action that are based on real-life actions and potential actions that a person may engage in. As a simulator, image schemas provide a kinesthetic feel that is not simply the output of some abstract computational machine, but the results of full-bodied experiences that have textures and a felt-sense of three-dimensional depth.[1] For example, when Hamlet says "To be or not to be, that is the question", he describes his suffering as an unbearable symmetry, a stasis. This remark is understood metaphorically in terms of BALANCE and how symmetrically opposed forces can sometimes lead to one feeling almost paralyzed. We do not simply understand Hamlet's comments in an abstract way, but implicitly interpret it by imagining what it feels like to be in this kind of situation, perhaps by recalling personal circumstances in which we have felt similarly. In this way, the embodied simulations involved in understanding language evoke bodily sensations that are directly related to the meanings we give to what people say or write.

The traditional focus in cognitive linguistics on image schemas as emergent from bodily experience sometimes fools people into thinking that image schemas function without much engagement from the rest of the body. But as Damasio (1994, 1999, 2003) has long argued, we have an ongoing awareness of our somatasensory system. Noting that the brain continually receives feedback signals from the body's autonomic processes, Damasio suggests that this feedback provides us with a constant background awareness of our own body's somatasensory systems. This low level of awareness is akin to mood that colors our ordinary consciousness:

> The background body sense is continuous, although one may hardly notice it, since it represents not a specific part of anything in the body but an overall state of most everything in it. (Damasio 1994: 152)

Adopting this perspective of image schemas as "simulations of bodily action" properly acknowledges how image schemas are "experiential gestalts" or "as-if body" loops that are actively created on-the-fly during different cognitive activity, and not as encoded structures in the head that are passively activated as part of unconscious linguistic understanding processes. Once more, this view of image schemas as simulations of bodily actions encompasses schemas that are traditionally seen as being more static, such

1. This can be read as a reply to Johnson's (*this volume*) concerns about image schemas as "fleshless skeletons".

as OBJECT. People continually simulate "static" schemas in a more dynamic manner than is mostly assumed in cognitive linguistics (see also Dewell, *this volume*).

4. Image schemas in language understanding

The claim that image schemas underlie linguistic meaning partly suggests that understanding sentences like *John stood at attention* requires listeners to engage in simulation processes which recreate an embodied model of what is meant. In fact, there is psycholinguistic research that is consistent with this idea. Although most of this work does not specifically mention "image schemas," the findings reported here are, at the very least, consistent with the idea that people are creating embodied construals of meaning as part of their imaginative understanding of linguistic expressions.

For instance, participants in one set of studies were presented with sentences such as *He hammered the nail into the wall* and *He hammered the nail into the floor* (Stanfield and Zwaan 2001). After reading a specific sentence, participants saw a picture depicting the object mentioned in the sentence (e.g., *the nail*). This picture either presented the object in a horizontal or vertical orientation, thus creating a match or mismatch with the orientation of the object implied by the sentence. In fact, comprehension responses were significantly quicker when there was a match between the implied orientation and the picture than when these were mismatched. These results support the idea that people create an image-schematic understanding of the verticality or horizontal nature of an event, even if these inferences are not explicitly mentioned in the linguistic statements.

A follow-up set of studies extended the previous findings to the representation of an object's shape in sentence comprehension (Zwaan et al. 2002). Participants saw sentences like *The ranger saw the eagle in the sky* followed by a picture of an eagle with either folded or outstretched wings. Not surprisingly, people gave faster recognition judgments to the eagle when the picture matched the shape implied by the sentence. A second study showed the same findings using a naming task that did not involve people matching the picture with the previous sentence. Once more, the results support the hypothesis that people create image-schematic construal of events alluded to in each expression.

Other experiments also show that people create dynamic, image-schematic construals of events as part of their understanding of linguistic

meaning. Zwaan, Magliano, and Graesser (1996) demonstrated that time shifts in narratives increase processing time. Thus, people reading the phrase *An hour later* after some event, take longer to process this phrase than when a minor time shift is implied, such as with the phrase *A moment later*. These findings are consistent with the "iconicity assumption" that events are assumed to occur in chronological order, but also occur contiguously. Other data indicate that continuing actions in sentences are more prominent in memory than are events not continuing. Thus, people are faster to say that *walked* is a word after reading the following pair of sentences *Teresa walked onto the stage. A moment later she collapsed.* than they did having first read the sentence *Teresa walked onto the stage. An hour later she collapsed.* Related studies show that embodied actions that continue remain more salient in mind than events that have been discontinued. Thus, people were slower to judge that *kicking* was a word after reading *Steve stopped kicking the soccer ball* than after reading *Steve was kicking the soccer ball* (Carreiras et al. 1997). These findings, again, show how people's construals of events, based on their embodied understandings, play an important role in the processing of linguistic expressions.

Very recent work indicates that image schemas are recruited during immediate processing of verbs (Richardson et al. 2003). A norming study first showed that participants were generally consistent in pairing four different pictures that reflect various image schemas (e.g., a circle, a square, an arrow looking up, down, left, or right) with different concrete and abstract verbs (e.g., *push*, *lift*, *argue*, *respect*). A second norming study had participants create their own image schemas for verbs in a simple computer-based drawing environment. Once more, there was good consistency in the spatial shapes people thought best described the meanings of the different verbs. These findings show that people have regular intuitions about the spatial representations underlying different verbs, even abstract ones.

Additional studies in this series showed that verbs activate underlying spatial representations during online language comprehension. For instance, in one study, participants heard a sentence (e.g., *The girl hopes for a pony*.) with two pictures presented sequentially in the center of the computer screen. The two pictures reflected different images of the main subject and object nouns in either vertical or horizontal position. Afterwards, participants were tested on their memory for the pictures in a speeded recognition task. As predicted, people recognized the pictures faster when they were oriented along the same axis as that of the associated verb (e.g., *hope* is associated with an arrow looking up). Verb comprehension appears to activate image

schemas that act as scaffolds for visual memory of the pictures. The pictures encoded as oriented similarly to the verbs' meanings were identified faster during the memory tests. These results suggest that verb meanings are actively linked with perceptual mechanisms that influence online comprehension and memory. One possibility is that different perceptual and motor experiences become associated with verbs, which are recreated as part of people's perceptual-motor simulations of the sentence during understanding.

Finally, different experiments demonstrate that previous embodied actions influence immediate symbolic, or semantic, judgments for simple linguistic statements. In these studies, participants were first asked to make hand shapes corresponding to verbal descriptions such as *pinch* and *clench* (Klatsky et al. 1989). Following this, the participants made speeded judgments on the sensibility of phrases such as *aim a dart* (sensible) or *close a nail* (not sensible). Embodied action relevant to the phrases facilitated people's speeded verifications of these phrases. For instance, the hand shape for *pinch* speeded the sensibility judgments for *throw a dart* but not *throw a punch*. Interestingly, when participants were asked to make verbal responses (but not hand shapes) to the nonverbal prime (e.g., the word *pinch* when shown the nonverbal signal for pinch), the priming effect was eliminated. It appears, then, that sensibility judgments, like online comprehension, require a type of mental simulation using an embodied, motoric medium.

These studies represent just a small part of the growing literature showing how immediate processing of nonfigurative language may involve different kinds of "as-if" embodied simulations. There are, of course, other possible interpretations of several of these studies. But this work is consistent with the possibility that language processing is not accomplished through the activation of pre-stored abstract representations, but by embodied simulations that are created on-the-fly in the very moment of understanding. Most generally, these studies offer support for the idea in cognitive linguistics that understanding meaning includes both conceptual content and construal (Langacker 1987; Croft and Cruse 2004).

5. Image schemas in metaphor understanding

Cognitive linguistics has long argued that image schemas have a critical role in structuring metaphorical concepts. Consider several examples of how image schemas shape people's metaphorical understanding of linguistic actions (Goossens et al. 1996). For instance, the image schema BALANCE (i.e.,

a symmetrical arrangement of forces around a point or axis) motivates various phrases referring to a person's attempt to restore equilibrium of the body (and mind). When people say *get something off my chest*, they describe a forceful action to remove an impediment that causes imbalance. Speakers who get something off their chests remove oppressive forces by merely talking to an appropriate person, often the person most responsible for placing the burden or impediment on the speaker. *Getting something off one's chest*, just like *blowing off steam* and *coughing something up* restore a sense of balance or well-being to an individual.

The image schema CONTAINMENT underlies many metaphorical concepts related to our understanding of linguistic action. For instance, our mouths, like our bodies, are experienced as containers, such that when the container is open, then linguistic action is possible, and when closed, there is only silence. To be *closed-lipped* reflects the silent, closed container, and when one *bites one's lip*, the closing of the mouth and lips is done quickly with great force. When someone *lies through their teeth*, the container is perceived as a hiding place where true information resides, but the container is somewhat defective and we can see through the speaker's shameless attempt to lie about something when the truth can partly be seen. Some metaphors talk of entering the mouth container, as when one *puts words in someone's mouth* or *forces/rams/thrusts something down someone's throat*, with the more forceful entering into the container reflecting greater intensity on the speaker's linguistic action. Embodied CONTAINMENT also refers to cases where objects, or (pieces of) information, are removed from the mouth or head of a speaker, as in *He took the words right out of my mouth* and *pick someone's brains*, both of which imply that they are persons possessing some valuable object(s) worth stealing.

The importance of the PATH image schema is seen in the metaphors based on walking, such as in *backtrack*, where the directionality of movement along some path must be reversed. PATH also is relevant to cases of reversed motion as in the eating metaphor of *eat one's words* and *eat crow*, which are specific instances of the general idea of *taking back one's words* (i.e., moving words back along the conduit path that a speaker first send them).

The image schema of FORCE is central to many of the metaphors based on violent bodily actions noted above. In most of these instances, the force is noticeable because of its extreme nature (e.g., *bite someone's head off* and *snap at someone*).

These selected examples illustrate how image schemas connect the domains of embodied action with the domain of linguistic action. Most gener-

ally, this examination of metaphor and linguistic action reveals how people use their intuitive phenomenological sense of their bodies to interpret, and better structure, more abstract conceptual domains. There is now a growing body of psycholinguistic research that supports the idea that image schemas play an important role in metaphorical language use. In previous articles, I have discussed in some detail the work showing how people's bodily experiences partly motivate their understanding of why the word *stand* has the various physical and nonphysical senses it has, e.g.: *The clock stands on the table.* and *He couldn't stand working for his boss*. (Gibbs et al. 1994).[2] An important methodological element of this research is the strategy to independently assess people's intuitions about their bodily experiences and use this information to make empirical predictions about other individuals' understanding of linguistic meaning. This strategy is important, in psychologists' view, because it helps eliminate some of the circular reasoning that cognitive linguists engage in when postulating the existence of image schemas from a systematic analysis of language only to test the theory by once more examining linguistic patterns.

Consider now two other sets of experiments that employed this methodological strategy to provide evidence in favor of the idea that image-schematic construal of experience shapes the understanding of metaphoric language. One set of psycholinguistic studies examined how people's intuitions of the bodily experience of CONTAINMENT, and several other image schemas, which partly structure the source domains for several important conceptual metaphors, underlie speakers' use and understanding of idioms. These studies were designed to show that the specific entailments of idioms reflect the source-to-target-domain mappings of their underlying conceptual metaphors (Gibbs 1992). Most importantly, these metaphorical mappings preserve the cognitive topology of these embodied, image-schematic source domains.

Participants in a first study were questioned about their understanding of events corresponding to particular bodily experiences that were viewed as motivating specific source domains in conceptual metaphors (e.g., the experience of one's body as a container filled with fluid). For instance, participants were asked to imagine the embodied experience of a sealed container filled with fluid, and then they were asked something about causation (e.g., "What would cause the container to explode?"), intentionality (e.g., "Does the container explode on purpose or does it explode through no volition of its

2. See also Beitel et al. (2000) for similar work related to understanding the various meanings of the preposition *on*.

own?"), and manner (e.g., "Does the explosion of the container occur in a gentle or a violent manner?").

Overall, the participants were remarkably consistent in their responses to the various questions. To give one example, people responded that the cause of a sealed container exploding its contents out is the internal pressure caused by the increase in the heat of the fluid inside the container. They also reported that this explosion is unintentional because containers and fluid have no intentional agency, and that the explosion occurs in a violent manner. These brief responses provide a rough, nonlinguistic profile of people's understanding of a particular source domain concept (i.e., heated fluid in the bodily container). These profiles are rough approximations of the image-schematic structures of the source domains.

These different image-schematic profiles about certain abstract concepts allowed me to predict something about people's understanding of idioms. Specifically, various source domains map onto their conceptualizations of different target domains in very predictable ways given the constraining influence of the underlying image schemas (i.e., the invariance hypothesis, Lakoff 1990). For instance, people's understanding of anger should partly be structured by their folk concept for heated fluid in the bodily container as described above. Several studies showed this to be true (Gibbs 1992). Not surprisingly, when people understand anger idioms, such as *blow your stack, flip your lid,* or *hit the ceiling,* they inferred that the cause of anger is internal pressure, that the expression of anger is unintentional, and is done in an abrupt violent manner. People do not draw these same inferences about causation, intentionality, and manner when comprehending literal paraphrases of idioms, such as *get very angry.* Moreover, people find it easy to process the idiomatic phrase *blow your stack* when this was read in a context that accurately described the cause of the person's anger as being due to internal pressure, where the expression of anger was unintentional and violent (all entailments are consistent with the entailments of the source-to-target-domain mappings of heated fluid in a container onto anger). But readers took significantly longer to read *blow your stack* when any of these source domain entailments were explicitly contradicted in the preceding story context.

These psycholinguistic findings demonstrate that people's intuitions about different image-schematic dimensions of experiences can be independently studied and then used to predict something about their use in understanding conventional metaphoric language. Of course, the image-schematic structuring of a concept, such as ANGER, does not imply that the concept is completely characterized by any single, or multiple, image schema (e.g.,

CONTAINMENT + FORCE). There are surely various concrete imagistic aspects of people's experiences of HEATED FLUID IN THE BODILY CONTAINER that are not image-schematic and this information may influence individual's answers to questions about the cause, intentionality, and manner of different events. Nonetheless, the high degree of consistency in people's answers to questions about the cause, intentionality, and manner of different source domain events is likely due to the constraining presence of underlying image schemas rather than to idiosyncratic mental images that people may have for these source domains (see Gibbs and O'Brien 1990).

A different line of research investigated the possible influence of bodily action on people's speeded processing of simple metaphoric phrases, as *stamp out a feeling, push an issue, sniff out the truth* and *cough up a secret,* each of which denote physical actions upon abstract items. Wilson and Gibbs (subm.) hypothesized that if abstract concepts are indeed understood as items that can be acted upon by the body, then performing a related action should facilitate sensibility judgments for a figurative phrase that mentions this action. For example, if participants first move their arms and hands as if to grasp something, and then read *grasp the concept,* they should verify that this phrase is meaningful faster than when they first performed an unrelated body action. Our hypothesis was that engaging in body movements associated with these phrases should enhance the simulations that people create to form a metaphorical understanding of abstract notions, such as "concept," even if "concepts" are not things that people can physically grasp. People's conceptual understandings of what a "concept" is, for example, need not be completely embodied and metaphorical. However, our suggestion is that some simulated construals of "concept" are rooted in embodied metaphor that may be highlighted by engaging in body actions relevant to what people mentally do with ideas.

Participants in this study first learned to perform various specific bodily actions (e.g., throw, stamp, push, swallow, cough, grasp) given different nonlinguistic cues. Following this, participants were individually seated in front of a computer screen. The experiment consisted of a series of trials where an icon flashed on the screen, prompting the participant to perform the appropriate bodily action. After doing this, a string of words appeared on the screen and participants had to judge as quickly as possible whether that word string was "sensible."

Analysis of the speeded sensibility judgments showed that participants responded more quickly to the metaphorical phrases that matched the preceding action (e.g., the motor action grasp was followed by *grasp the con-*

cept), than to the phrases that did not match the earlier movement (e.g., the motor action kick was followed by *grasp the concept*). People were also faster in responding to the metaphor phrases having performed a relevant body moment than when they did not move at all. In short, performing an action facilitates understanding of a figurative phrase containing that action word, just as it does for literal phrases. A second study showed that same pattern of bodily priming effects when participants were asked to imagine performing the actions before they made their speeded responses to word strings. This result reveals that real movement is not required to facilitate metaphor comprehension, only that people mentally simulate such action.

Most generally, people do not understand the nonliteral meanings of these figurative phrases as a matter of convention where their understandings of different phrases is arbitrarily given in a rote fashion. Instead, people actually understand *toss out a plan*, for instance, in terms of physically tossing something (i.e., the plan is viewed as a physical object). In this way, processing metaphoric meaning is not just a cognitive act, but involves some imaginative understanding of the body's role in structuring abstract concepts. People may create embodied simulations of speakers' messages that involve moment-by-moment "what must it be like" processes that make use of ongoing tactile-kinesthetic experiences. These simulations processes operate even when people encounter language that is abstract, or refers to actions that are physically impossible to perform. My claim that people engage in bodily simulations when understanding phrases like *grasp the concept* does not imply that they must access the literal meaning of the phrase before inferring its metaphorical interpretation. Instead, people's immediate construal of metaphoric meaning is shaped by bodily simulation processes which do not require that a literal meaning be examined and rejected.

6. Image schemas as simulated actions: A case study

The research described above offers empirical findings that seem very compatible with the possibility that image schemas maintain their embodied roots and help create imaginative construals of linguistic meaning. I now describe in some detail an interesting new line of research that provides more direct evidence in favor of the idea that image schemas are different kinds of simulated action. This work focuses primarily on the conceptual metaphor RELATIONSHIPS ARE JOURNEYS, whose source domain is primarily structured by the image schema SOURCE-PATH-GOAL. In this work, college stu-

dents listened to one of two kinds of stories about romantic relationships, as shown below (Gibbs, in prep.):

> *Smooth Journey*
> "Imagine that you are a single person. A friend sets you up on a blind date. You really like this person and start dating a lot. Your relationship was moving along in a good direction. But then it got even better. The relationship felt like it was the best you ever had. This continues to this day. No matter what happens, the two of you are quite happy together."
>
> *Interrupted Journey*
> "Imagine that you are a single person. A friend sets you up on a blind date. You really like this person and start dating a lot. Your relationship was moving along in a good direction. But then you encountered some difficulties. The relationship did not feel the same as before. This lasted for some time. No matter how hard you two tried, the two of you were not getting along."

These two stories describe relationships as being like a journey, as indicated solely by the statement *Your relationship was moving along in a good direction* in the fourth line of each story. Although no other part of the two stories refers to journeys in any way, the two stories differ in the kind of metaphorical journey (i.e., SOURCE-PATH-GOAL schema) that each relationship takes. The first story gives the impression of a smooth, uninterrupted journey, and the second of a more difficult, perhaps interrupted, journey. My basic hypothesis was that people understand these two stories not by merely activating a RELATIONSHIPS ARE JOURNEYS conceptual metaphor, in which the source domain is structured by the SOURCE-PATH-GOAL image schema. Instead, people imaginatively simulate themselves in the journey and actually experience some embodied sense of the SOURCE-PATH-GOAL schemas as part of their understanding of the stories. If this is the case, listening to these different renditions of the RELATIONSHIPS ARE JOURNEYS conceptual metaphor should have different embodied effects on the people who understand them.

To test this idea, I first asked a group of students to read the two stories and then answer as series of questions that were designed to tap into the students' intuitions about relationship journeys and the implicit image-schema of SOURCE-PATH-GOAL that underlies the source domain of this metaphor. The first question asked, "Which relationship progressed further?" to which 90% of the participants responded the smooth journey story (the stories were not actually labeled like this). The second question was "Which relationship was progressing faster at the beginning?" which pro-

voked a split in the participants' responses with 45% saying the smooth journey story and 55% the interrupted journey story. The third question was "Which relationship is progressing faster at present?" to which 90% of the participants picked the smooth journey story. The fourth question asked, "Which relationship progressed more along a straight line?" to which 60% picked the smooth journey story. Finally, the participants were asked, "In which relationship were the individuals heading in the same direction?" to which 80% selected the smooth journey story.

It is important to note that there is nothing in the individual stories that directly assert anything about the distance, speed, extent, and direction of the journeys traveled. All of these inferences were drawn on the basis of people's metaphorical understandings of the stories as referring to RELATIONSHIPS ARE JOURNEYS. The data clearly suggest that the couple in the smooth story had progressed further overall, were doing so faster at the present time, were moving more along a straight path, and were headed in the same direction, compared to the couple depicted in the interrupted journey story. The question, then, was whether these detailed SOURCE-PATH-GOAL image-schematic understandings of the stories had any embodied influence on people as they imaginatively constructed their interpretations.

I examined this possibility in the following way. Groups of college students individually participated in an experiment on a large athletic field at the University of California, Santa Cruz. Each experiment began with a student standing on one spot looking out at a large yellow ball that was placed exactly 40 feet away. As the students stood and stared out at the yellow ball, they were read one of the two stories above. Immediately after hearing the story, the participants were blindfolded, and asked to walk out to the yellow ball while they were "thinking about the story" they had just heard. At that point, students began to walk out to where they thought the yellow ball was and then stopped when they thought they were right at the ball. Once they stopped, an experimenter nearby asked each participant to rate on a 7-point scale (from "bad" to "good") how they felt at the moment. After this, the blindfold was removed, and the experiment was over. The experimenters then measured how close the student actually was to the yellow ball, and how far away from a straight line each participant wandered from the starting point to the yellow ball.

Did students walk differently having heard the smooth journey as opposed to the interrupted journey story? In fact they did. According to the preliminary study, students hearing the smooth journey story assumed that the relationship progressed further than the one in the interrupted journey.

Indeed, in the walking study, blindfolded students who heard the smooth journey story walked past the yellow ball by almost 4 feet on average, while the students who heard the interrupted journey undershot the yellow ball by more than 1 foot, a statistically significant difference. This difference in walking distance was not due to participants being happier or in a better mood because they simply heard a more positive story as indicted by the fact that the students who heard the interrupted journey actually gave higher mood ratings than did those in the smooth journey condition. I am not sure how to explain this mood difference between the two story conditions. At the very least, though, these mood ratings eliminate the alternative explanation that longer walking distance was due to the participants being momentarily happier.

A different version of this experiment had college students listening to the same stories, again looking out at the yellow ball. This time, however, students were blindfolded, but instructed to only imagine themselves walking out to the yellow ball as they thought about the story, and to press a stop watch as soon as they imagined themselves arriving at the ball. Interestingly, the identical pattern of effects was obtained as found during real walking. It appears, then, that thinking about the two stories differentially affected people's imagined walking, and it did this for both real and imagined motion.

This line of research is still in its infancy. But the findings observed in these experiments strongly suggest that image-schematic reasoning in narrative comprehension involves the construction of embodied simulations. These simulations are embodied because of the functioning of "as-if body" loops that are part of people's immediate understanding of other individuals' actions, including those associated with overt communication. One implication of this view is that people's aesthetic appreciation of language is itself embodied. Instead of people first understanding language, and then having emotional/aesthetic responses to it, people experience emotions as part of their immediate simulated construals of meaning. Thus, we feel something when reading or thinking about a successful or interrupted relationship journey because of the embodied "as-if" simulations that are being created during our image-schematic (e.g., SOURCE-PATH-GOAL) construals of each respective relationship.

7. Image schemas as attractors within self-organizing systems

The emergent nature of image schemas as in-the-moment embodied simulations is best understood theoretically in terms of the complex interplay of brain, body, and world. Many cognitive scientists now argue that understanding this complex interaction requires the tools and methods of nonlinear dynamical systems theory (Freeman 2001; Kelso 1995; Port and Van Gelder 1995; Thompson and Varela 2001). Dynamic approaches to cognition emphasize that learning is a self-organized process that occurs only in systems that are environmentally embedded, corporeally embodied, and neurally entrained by feedback. Virtually all living organisms self-assemble, or are self-organizing systems, "as emergent consequences of nonlinear interaction among active components" (Kelso 1995: 67). The nervous system, the body, and the environment are highly structured dynamical systems, coupled to each other at multiple levels. Three kinds of cycles are most relevant to creating self-organization (Thompson and Varela 2001): cycles of organismic regulation of the entire body, cycles of sensorimotor coupling between organism and environment, and cycles of intersubjective interaction, involving the recognition of the intentional meaning of actions and linguistic communication.

For the present purpose, image schemas may be described as emergent properties that arise from different "cycles of operation" constituting a person's life and represent a kind of "structural coupling" between brain, body, and world. Image schemas reflect a form of stability within cognitive systems. According to self-organization theory, order in a system arises around what are called "attractors," which help create and hold stable patterns within the system. Attractors are preferred patterns, such that if the system is started from one state it will evolve until it arrives at the attractors and will stay there in the absence of other factors. An attractor can be a point (e.g., the center of a bowl containing a rolling ball), a regular path (e.g., a planetary orbit), a complex series of states (e.g., the metabolism of a cell), or an infinite sequence (called a "strange attractor"). A complex system will have many attractors and the study of self-organizing systems is focused on investigating the forms and dynamics of these attractors.

My suggestion is that image schemas are attractors within human self-organizing systems. Attractors, such as BALANCE, SOURCE-PATH-GOAL/PATH, RESISTENCE, VERTICALITY, etc., reflect emerging points of stability in a system as it engages in real-world interaction. New, surprising, patterns encountered in the environment throw a system into momentary

chaos (e.g., the system goes out of BALANCE), until the system, through its self-assembling process, reorganizes and reaches a new stability (e.g., reaches a new state of equilibrium or BALANCE). The important point here is attractors are not localized representations, but emerging patterns of entire systems in action (i.e., the interplay of brain, body, and world). In this way, the stable properties of image schemas (e.g., the topographic structure of something like SOURCE-PATH-GOAL) are not separate from sensorimotor activity. Image schemas should not be reduced to sensorimotor activity, and it is also a mistake to view image schemas as mental representations that are abstracted away from experience. One implication of this dynamical view is that each construal of an image schema will have a different profile depending on the overall state of the organism involved in some activity, and past basins of attractions created within the system (i.e., past simulations of particular behavioral modes such as BALANCE).

8. Conclusion

My argument has been that image schemas are created on-the-fly as part of people's ongoing simulations of actions when they engage in cognitive tasks, such as understanding language. Image schemas are not divorced from their bodily origins, despite their emergence from recurring patterns of bodily experience, nor are they structured as pre-stored entities in long-term memory. Instead, image schemas are emergent properties of human self-organizing systems that are continually recreated and re-experienced during cognitive and perceptual activity. This perspective helps restore image schemas to their rightful status as "experiential gestalts" that are psychologically real, not because they are part of the mind, but because they are meaningful, stable states of embodied experience.

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