Chapter 9
Image Schemas
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1. Introduction

Performing a mundane activity, such as walking to a library, selecting a book from the collection, bringing it to the circulation desk, checking it out, and taking it home, is of complexity far outstripping any known formal description of it. Such routines involve the coordination of multiple acts of sensing, perceiving, moving, and conceptualizing in a three-dimensional world. It is these mundane activities that are most likely to reveal the basic features of human thought and language. Walking to the library already depends on a long history of simpler experiential patterns filtered through culture and the individuals it claims as its own. The exact nature and number of these simpler patterns is still not well understood, but one entity proposed as a supporting structure for human thought and language has become a touchstone notion for all cognitive linguists. This entity is known as an *image schema*.

The locus classicus of image schema theory is Lakoff and Johnson's (1980) conceptual theory of metaphor. Since then, image schema theory has helped Johnson establish an epistemology and moral philosophy (1987, 1993), and has helped Lakoff articulate a theory of categorization (1987). Subsequently, image schema theory has played a major role in several areas of study: in psycholinguistic investigations by Gibbs (1994) and Gibbs and Colston (1995), in cognitive development by Mandler (1992), in poetics by Lakoff and Turner (1989) and literary criticism by Turner (1987, 1991), in linguistic theories of grammar by Langacker (1987) and Talmy (1983), in mathematics (Lakoff and Núñez 2000) and in computational modeling by the Neural Theory of Language Group.

Briefly, an image schema is a condensed redescription of perceptual experience for the purpose of mapping spatial structure onto conceptual structure. According to Johnson, these patterns "emerge as meaningful structures for us chiefly at the level of our bodily movements through space, our manipulations of objects, and our perceptual interactions" (1987: 29).

Image schemas behave as 'distillers' of spatial and temporal experiences. These distilled experiences, in turn, are what Cognitive Linguistics regards as the basis for organizing knowledge and reasoning about the world. Accordingly, going to the library and getting a book can be conceptually grouped with a number of instances with little in common save for exhibiting the same image-schematic structure.

This chapter constitutes a primer to the notion of image schemas in Cognitive Linguistics by presenting a preliminary sketch of its terminological history, reviewing a range of studies illustrating the application of image schemas, as well as reviewing studies that establish the psychological and neuropsychological reality of image schemas. I conclude this chapter with a brief discussion of some general theoretical issues concerning the nature of image schemas.

2. Preliminary Distinctions

2.1. Schemas, Images, and Image Schemas

Image schemas are neither images nor schemas in the familiar senses of each term as used in philosophy, cognitive psychology, or anthropology. Therefore, I will 'reverse engineer' this composite structure, examining each component part before reconsidering it in its composite form. I will begin with the second term.

Johnson credits Immanuel Kant with devising the notion of *schema* as a way of relating percepts to concepts. For Kant, schemas are structures of the imagination, and imagination is the mental faculty that mediates all judgment; hence, imagination is the faculty for synthesizing different modes of representation (sensory percepts, images, concepts, and so on) into concepts. A Kantian schema is a structure of the imagination shared by individuals, but irreducible to conceptual and propositional content. The notion of schema is something like "rationality without rules" (Johnson 1987: 161). For example, Kant argues that "the empirical conception of a *plate* is homogenous with the pure geometrical conception of a *circle*, inasmuch as the roundness which is cogitated in the former is intuited in the latter." Kant then uses this example to posit schemas as "mediating representations" with no empirical content "yet [which] must on the one side be *intellectual*, on the other *sensuous*" ([1781] 1990: 100–101). Schemas, then, are fixed templates superimposed onto perceptions and conceptions to render meaningful representations.

Schemas as 'fixed templates' for generating meaningful representations did not originate with Kant, however. The Greek origin of the term *schema* and its plural *schemata* should tip readers off that the very notion has a long intellectual history in the West. Meaning 'form' or 'figure', *schema* provided Greek and Roman rhetoricians with a name for a class of linguistic devices for generating or embellishing arguments. Rhetorical schemas were often contrasted with tropes and figures of thought—e.g., metaphor and metonymy, primarily because schemas exploit formal syntactic patterns, while tropes do not. Richard Lewontin's now famous quip, "Just as there is no organism without an environment, there is no environment without an organism," is a prime example of *antimetabole*, a template for replicating the nouns from the first colon in inverse grammatical slots in the second colon. Once available, such schemas can generate new and memorable expressions. Ancient rhetoricians regarded these forms as more-or-less static templates superimposed onto language.

In addition to philosophy and rhetoric, the notion of schema is now a permanent addition to the anthropology and cognitive science lexicons. Even though researchers look slightly differently at the notion of schema and related concepts like 'script', 'scene', and 'scenario', a definition of schema as "a cognitive representation comprising a generalization over perceived similarities among instances of usage" (Kemmer and Barlow 2000: xviii) would likely elicit widespread agreement among them. By repeatedly 'activating' a set of properties in a particular way, individuals develop 'top-down' frames for construing different facets of experiences, with each repeated instance becoming "an organized framework of objects and relations which have yet to be filled in with concrete detail" (D'Andrade 1995: 122). For example, walking into my campus library activates my schema for UNIVERSITY LIBRARY that includes slots for such roles as 'librarian', 'patron', 'student', 'faculty', any of which can be filled with specific values.

Human beings generate mental images all the time. In Cognitive Linguistics, the term image implicates perception in all acts of conceptualization. Concepts (even abstract concepts) develop from representations of a perceptual conglomeration of visual, auditory, haptic, motoric, olfactory, and gustatory experiences. Images are always analog representations of specific things or activities.

While immediate perceptions form the basis of mental imagery, the images themselves are abstractions in which the individual can fill in details as he or she frames new

experiences. A detailed mental model of my own campus library is specific only to that institution and no other; which is why I know I am in this library and not some other library. Experiences with a particular institution, however, can serve as an imaginative base for creating a 'schematized' mental image of a library.

To summarize thus far, a schema has been historically defined as a fixed template for ordering specific information, whereas an image has been defined as a representation of specific patterns capable of being rendered schematically.

As a composite notion, image schemas are neither fixed nor specific, even as they manifest characteristics of each. Many image schemas have 'topological' characteristics, insofar as they constitute 'spaces' sectioned into areas without specifying actual magnitude, shape, or material. Lack of specificity and content makes image schemas highly flexible preconceptual and primitive patterns use for reasoning in an array of contexts (Johnson 1987: 30).

Johnson (1987: 126) lists the most important image schemas as follows (rendered according to convention in small capitals): CONTAINER; BALANCE; COMPULSION; BLOCKAGE; COUNTERFORCE; RESTRAINT REMOVAL; ENABLEMENT; ATTRACTION; MASS-COUNT; PATH; LINK; CENTER-PERIPHERY; CYCLE; NEAR-FAR; SCALE; PART-WHOLE; MERGING; SPLITTING; FULL-EMPTY; MATCHING; SUPERIMPOSITION; ITERATION; CONTACT; PROCESS; SURFACE; OBJECT; COLLECTION.

On analysis, complex conceptualizations like the library routine fit an image-schematic profile, a combination of image schemas that comprises the topological structure and which allows it to be grouped with other instances of 'going and getting'. For instance, going to the library fits the following image-schematic profile: SOURCE-PATH-GOAL – CONTAINER – COLLECTION – PART-WHOLE – TRANSFER – ITERATION. The library exists as the end point to a path. It also has an inside and an outside, and thus is capable of containing people and objects. Since the objects it contains are of the same kind, the library exploits the notion of collection, which piggybacks on the opposition between part and whole. Physically possessing one of these contained objects in the collection exploits the TRANSFER schema, and its repeatability exploits the ITERATION schema. The above profile represents some of the most conceptually assessable schemas used to structure a working notion of library.

2.2. Image-Schema Transformations

Abstract reasoning depends on the ability to map perceptual categories onto higher-order conceptual categories. Our conceptualizations involve transformations of image schemas (see Johnson 1987: 25–27; Lakoff 1987: 440–444; Turner 1991: 177; Gibbs and Colston 1995: 347–378; Palmer 1996:68–74;). Most simple events and actions involve transformations of image schemas. Lakoff (1987: 443) identifies four primary transformations (see also Johnson 1987: 26):

a. *Path focus to end-point focus*. Imagine the path of a moving object and then focus attention on the point where it comes to rest or where it will come to rest.
b. *Mutiplex to mass*. Imagine a cluster of objects. Now imagine moving away from the cluster until the individual objects start to appear as a homogenous mass. Then move back to the point where the mass turns into a cluster again.
c. *Trajectory*. Mentally traverse the path of a continuously moving object.
d. *Superimposition*. Imagine a large sphere and a small cube. Now, increase the size of the cube until the sphere can fit inside it. Now reduce the size of the cube until it fits back inside the sphere.

Consider these transformations from the perspective of the library routine discussed above. Walking to the library involves a *path focus to end-point focus* transformation, whereby one can imagine moving along a path and then shift focus to the point where one is to stop, or where one meets resistance, such as a set of locked doors (Johnson 1987: 26). Selecting a book from a large shelf of books can proceed by a *mass to multiplex* transformation. In this case, the shelf appears first from a distance as a single homogenous mass that turns into a cluster of individual items as one moves closer. Remembering the familiar path to the library involves a *trajectory* transformation, whereby one mentally scans the environment along the way. Finally, imagine removing two books, one larger than the other, from the shelf. Shuffle the two books so that at one moment the folio text supports the quarto text, at another moment the quarto text supports the folio text, producing alternating experiences of superimposition. At one moment, the quarto text is fully actualized visually while the folio text is partially occluded visually; at another moment the quarto text is fully occluded visually and the folio is fully actualized visually. The *superimposition* transformation is one way the mind registers Figure/Ground organization, asymmetry, and dependence. In these instances, image-schema transformations capture dynamic properties of ongoing activities; they are properties of action and their experience is made real only with respect to a dynamic routine.

3. Image Schemas in Cognitive Linguistics

Cognitive linguists assume that grammar is inherently meaningful, that the lexical and grammatical items reside on a continuum of meaning from specific to schematic, and that all linguistic structures are instantiated as parts of idealized cognitive models (Lakoff 1987: 113–114). An idealized cognitive model for library consists of a prototype and several less-than-prototypical instances (e.g., noncirculating libraries) constituting a radial semantic network of interrelated meanings. Image schemas and their transformations operate as structuring principles of the idealized cognitive model: they ‘glue’ these complex networks together.

If idealized cognitive models and the image schemas that make them possible constitute a fundamental means by which human beings structure knowledge, then they must also make language possible. This is the position of Cognitive Grammar, the predominant theoretical framework used in the studies reviewed below. According to Langacker (1987, 1991), all grammatical structures are meaningful, however schematic. For something to count as a grammatical item in Cognitive Grammar, it must meet the *content requirement* of a symbolic structure, which includes a phonological and a semantic component (or ‘poles’), specific categorizing relationships for integrating these components with other structures, and schemas for organizing and extending these structures into different (and usually increasingly abstract) domains. The English preposition *from* is a symbolic structure whose semantic component has been schematized so as to be extendable across a wide range of conceptual domains. Specifically, the meaning of this preposition issues from the image-schematic component SOURCE in a SOURCE-PATH-GOAL schema, thereby allowing it to function as an ‘elaboration site’ for orienting attention to an entity. The prepositional phrase *from the library* construes the library as a point of departure for a destination as a salient dimension of its meaning.

Image schema theory plays an important role in studies of the polysemy of individual words or constructions, of related words or constructions, and of semantic change and grammaticalization. It has also been used in literary and textual analysis.

3.1. Studies of the Polysemy of Individual Words or Constructions

This section presents a review of specific studies of words and constructions relying on image schema theory. Every study seeks to show how the symbolic structure in question forms a complex network of related senses, each of which profiles a slightly different feature of an idealized cognitive model. The following review of lexical to grammatical items will necessarily be brief and incomplete but sufficient to provide a general map of the critical terrain.

Casad (1995) conducted an extensive study of the verb *give* (variations of the verb stem *P*^{w}*é̃ihve'e*) in Cora, a Southern Uto-Aztecan language. He found four different types of giving, each with its own specific image-schematic characteristics. The four types of giving include personal interest giving, transport giving, enabling giving, and terminative giving, each a variation of a prototype of giving that entails "one person, using his hands, who physically transfers a discrete entity into the hands of a second person, and, by doing so, also transfers to that second person control over the entity in question" (Casad 1998: 138). The idealized cognitive model for personal interest giving matches the prototype and includes three entities, a giver, a thing, and a recipient, with salient attention focused first on the giver and thing and subsequently on the recipient and thing, and with attention also paid to the motion of the thing from giver to recipient. In sum, personal interest giving regularizes as a canonical instance of the SOURCE-PATH-GOAL schema. A related model focuses attention not on the thing itself but on the CONTAINER of the thing given, as in a vessel of drinking water. This is an instance of transport giving. The third type is of the enabling variety. With this type, an 'instigative agent' does something that will enable the recipient to do some other action. Thus, a giver may transfer a vessel of water to a recipient, but focusing attention is on the subsequent enabled actions of the recipient. A fourth type of giving, terminative giving, involves the use of a motion verb and the applicative suffix *-ira* with the agent giver and patient recipient encoded morphologically into the verb. The focus is most salient on some aspect of the recipient with only secondary focus on the transported object, as in *I am going to give it back to him.*

Pauwels's (1995: 56) study of the verb *put* suggests that the CONTAINMENT schema and its entailments are crucial for understanding this verb's various metaphorical usages: from those profiling an inferred destination, as in *put in a good word for me*, to those profiling a loss of control, as in *put out a statement*.

In Cienki's (1998) study of *straight*, he presents evidence that STRAIGHT is an image schema as it represents a recurrent pattern of action, perception, and conception. Cienki offers evidence, mostly from English and Russian (variants of *prjamo*), that sensory-perceptual meanings of *straight* are metaphorically extended into abstract domains of speech, thought, time, and behavior. Both Russian and English evidence *straight* as either an object or location metaphor. For instance, speech, thought, time, and behavior can be expressed as straight objects (e.g., *a straight answer*) or alternately as self-propelled motions along a rectilinear path (e.g., *Say it straight to my face!*). Cienki argues that *straight* has much in common with VERTICALITY schemas, and *straight* correlates strongly in theses languages with UP, while antonyms like *bent* correlate with DOWN. *Straight* marks a recurring regularity with our everyday perceptual interaction with the world, which, in turn, provides reason to believe that it patterns our everyday social interactions as well. Even non-Indo-European

languages like Hungarian and Japanese evidence regular extensions of *straight* into abstract domains of speech and morality, such that maximally INFORMATIVE SPEECH IS STRAIGHT and MORALITY IS STRAIGHT, while its opposites are *bent*, *curved*, *convoluted*, or *crooked*.

Ekberg (1995) analyzes various linguistic manipulations of the VERTICALITY schema in English and Swedish and argues that there are five principles of transformation of the canonical VERTICALITY image schemas. The first principle is the cognitive operation of transforming a vertical axis into a horizontal one by 'tipping' it over. Such transformations allow for the extended use of Swedish *upp* 'up' and *ner* 'down' along a horizontal plane; thus, one can say *Han gick upp och ner i korridoren* 'He walked up and down the corridor', even though the objective axis is horizontal. A second principle is end-point focusing where *upp* indexes a location at the end of a mentally traceable vertical trajectory, as exemplified in *Hon bodde en trappa upp* 'She lived one floor up'. A third principle is the metaphorical mapping from the physical to the temporal; thus, expressions like *tankar som når upp i vår egen tid* 'thoughts that reach up into our own time' understand time as a mover along a vertical path. The other two principles include the transformation of a zero-dimensional entity tracing a path to a one-dimensional extended entity and deictic orientation according to the 'me-first' principle, with the former principle exemplified in *Klänningen nådde ner till anklarna* 'The dress reached down to the ankles' and the latter exemplified in usages where inanimate objects acquire characteristics of human bodies, e.g., *Han satt längst upp vid bordet* 'He sat at the head of the table'. Ekberg offers an array of linguistic evidence to support the notion that image-schematic characteristics pervade the meaning structures of even the most commonplace grammatical items.

Serra-Borneto (1995a) argues that image schemas can be used to explain certain exceptions to the general rule governing the use of dative and accusative case markers for two-way prepositions in German, such as *an*, *auf*, *hinter*, and *in*. In general, the dative case applies to static relationships between participants while the accusative applies to dynamic relations. This rule works fine for examples like *Hans geht in den Garten* 'Hans goes into the garden', with accusative *den* signaling a dynamic relationship, and *Hans sitzt im Garten* 'Hans sits in the garden', with dative *im* signaling a static relationship. The rule does not seem to apply for examples like *Das Flugzeug über der Stadt* 'The airplane over the city' because the dative *der* marks an ostensive dynamic relationship. Serra-Borneto shows how the entailments of CONTAINMENT—protection from, limits, fixity of location, opaqueness—motivate the different uses of dative markings in two-way prepositions. It makes sense to use the dative in the above example when speakers mean that the plane stays within the city's airspace.

In a similar fashion, Smith (2002) analyzes the many meanings of the third-person neuter pronominal *-es* in German, whose range of use extends well beyond the prototype as a grammatical anaphor, referring to non-neuter antecedents and whole settings, both concrete and abstract. Smith argues that *-es* reflects an abstraction of the CONTAINMENT schema in which it profiles not only entities within a region but the whole region in which an event or state of affairs occurs.

Watters's (1995) study of Tepehua, a Totonacan language spoken in eastern Mexico, analyzes the various uses of applicative forms for stative and nonstative verbs based on image schema theory. His study focus specifically on the suffix *ni-* and prefixes *-puˑ* and *-łi*. When applied to a stative verb, *ni-* means something like *at*, which functions image-schematically like a Ground in a Figure/Ground relationship. When applied to a nonstative verb, *ni-* means something like the GOAL component of an SOURCE-PATH-GOAL schema. As with other grammatical instances, the spatial meaning of these forms is basic, as is especially the case with *-puˑ*, where the basic directional meaning is extended to include duration.

3.2. Studies of the Polysemy of Related Words or Constructions

In addition to studies of individual items, several studies of closely related words—such as Delbecque's (1995) on the Spanish prepositions *por* and *para*—show how differences in image-schematic structures account for their different meanings. Here is a brief description of two such studies.

Serra-Borneto (1995b) explored the image-schematic constraints governing the use of the German locative verbs *liegen* 'to lie' and *stehen* 'to stand' in perceptual and nonperceptual contexts. The data suggest that *stehe*n encodes verticality and *liegen* encodes horizontality, but also that *stehen* can apply to objects with a 'base', while *liegen* applies to cases where either horizontality is the one salient dimension or where referents lack dimensional saliency altogether, such as in cases referring to nonperceptual and 'geotopographical' locations. For instance, one can say *Der Punkt liegt auf der Gerade* but not **Der Punkt steht auf der Gerade* 'The point is on the line', and one can say *Frankfurt liegt am Main* but not **Frankfurt steht am Main* 'Frankfurt is on the Main', since a point in space or on a map possesses no salient vertical dimension. As with the other studies discussed above, Serra-Borneto shows how image schema theory provides a cognitive explanation for subtle meaning differences leading to different grammatical realizations. Williams (1992) also shows this in his treatment of *over*, *under*, and *out* in English comparatives like *overdone*, *underinsured*, and *outmaneuvered*. Williams argues that the particles *over* and *under* prompt us to project two entities (one of which is often implicit) or events against some pragmatic scale for assessing and comparing the target value. The meaning of adjectives *overdone* and *underdone*, for instance, involves relative scales of doneness in cooking. In contrast, *outmaneuver* exploits the notion of CONTAINMENT, with *out* locating and relating entities with respect to a domain of influence. Thus, if a forward in ice hockey *outmaneuvers* the goalie, we understand that the forward (at that moment) occupies an area of speed and skill not within the control of the goalie.

3.3. Studies of Semantic Change and Grammaticalization

The studies reviewed in this section focus on issues of semantic change.

Rhee (2002) proposes four processes involved in semantic change—metaphor, generalization, subjectification, and frame-to-focus variation—as demonstrated by his analysis of the English preposition *against*. Evidence suggests that the original meaning of physical directionality expanded to cover relationships of temporal proximity and approximation; thus, semantic change occurs through metaphoric mapping from the spatial to the temporal domains. Semantic change also occurs through generalization, with *against* initially applying only to tangible entities in opposition and subsequently applying to less tangible and associated entities. Rhee's principal argument is that semantic change involves image schemas and their transformations. When meaning changes, details of source images are generally ignored but schematic structures are preserved. This is one reason *against* can acquire seemly contrasting meanings: each meaning profiles a different image-schematic component of a scene. 'Towards'-*against* focuses on an entity moving along a path, 'opposed'-*against* focuses on a countering force moving in the opposite direction from a moving entity, while 'near'-*against* is a consequence of our ability to construe a scene 'from afar', whereby the entire scene reduces to a small dimension with no visible path.

Both Smith's (1999) study of the Russian instrument marker (*om*) and Verspoor's (1995) study of predicate adjunct constructions make essentially the same argument that

semantic change preserves image-schematic structure. For instance, Smith claims that the prototype of an action chain where the instrument is a conduit for energy flow accounts for some puzzling uses of the instrument marker in Russian, such as to indicate impermanence and irrealis. Similarly, Verspoor offers a detailed explanation for why *Michael wiped the table clean* and *Michael considers the table clean* instantiate the same grammatical construction. The same schema is preserved in both sentences, in that the act of 'considering XY' is metaphorically understood in terms of moving an entity from one place to another, thereby altering its state.

The hypothesis that semantic change involves image schema preservation is not without controversy among cognitive linguists, however. Matsumoto (1995) shows that the hypothesis is challenged by the development of two causal markers in Japanese, *ni-yotte* and *tame*, and therefore argues that, at best, only a weak form of this hypothesis is partially viable. Indeed, the development of *ni-yotte* from cause to purpose does not preserve the CAUSAL CHAIN schema; rather, the meaning change seems motivated by the opposite attributive schema of tracing back to a source. Certainly, image schemas are important theoretical notions for studying semantic change and grammaticalization; however, the notion that semantic change involves image schema preservation is a matter of considerable debate.

3.4. Literary and Textual Analysis

Image schema theory has also been instrumental in the development of cognitive approaches to literary and textual criticism, most notably with Turner's work on the nature of linguistic creativity in both everyday and highly artistic contexts. In one noted article, Turner (1992) argues that the *invariance principle* accounts for much of what is systematic about metaphor, using bare equations, such as *Kingdoms are clay* and *Language is a virus*, as they occur in artistic and inartistic contexts. The invariance principle states that the mapping from the source cannot violate the image-schematic structure of the target. For instance, speakers of English are likely to interpret *Kingdoms are clay* as pertaining to the impermanence and temporary nature of the target subject; hence the interpretation 'Kingdoms crumble like clay' insofar as we can understand kingdoms as coming into and going out of existence; or, 'Kingdoms can be molded out of clay' insofar as we can understand them as being shaped. What would not be a likely interpretation is 'Kingdoms have a reddish-brown hue', since colorful objects are not a salient part of the underlying schematic structure of the target domain.

Turner's larger point is to counter a prevailing assumption among contemporary critical and literary theorists that no stable or reliable forms of communication actually exist. Freeman (1995, 2002) assumes the same critical perspective, but instead of seeking to reveal the nature of the human imagination generally, she seeks to show how image schema theory can in fact produce better, more reliable literary interpretations. In a recent article, Freeman (2002) counters the common assumption that the poet Robert Frost had a clear poetics that runs throughout his oeuvre but that Emily Dickinson did not. Freeman suggests that image schema theory helps show that Dickinson's oeuvre can be interpreted as the careful working out of a poetics quite distinct from Frost's. In essence, Frost uses the schemas of PATH and BALANCE while Dickinson uses the schemas of CONTAINER, CHANGE, CYCLE, and CIRCLE to structure her poetic imagery.

Other work in textual analysis focuses on the metaphorical structure of nonliterary domains or disciplines and their textual instantiations. Romaine (1996) and Boers and Demecheleer (1997) have each studied conventional metaphors structuring discourse about

economics and conflict. To take just one example, Boers and Demecheleer conducted extensive corpus analysis of economic discourse in English, French, and Dutch and found three general conventional metaphorical models accounted for the data, the most prevalent in English being the PATH metaphor, as exemplified in such common metaphors as PROGRESS IS MOVING FORWARD, and DECISION MAKING IS CHOOSING A DIRECTION, among others.

4. Psychological Considerations

This section reviews a selection of studies in psycholinguistics, cognitive development and language acquisition, and neurocomputational modeling for the psychological reality of image schemas.

4.1. Psycholinguistics

Gibbs et. al. (1994) explored the polysemy of *stand* in a series of four interlocking experiments with the explicit aim of empirically supporting the notion that image schemas organize experience and as such organize semantic structure.

First, after a brief period of standing up, moving around, bending over, crunching, and stretching, subjects were read descriptions of twelve different image schemas related to acts of standing, and were then asked to rate the relevance of each image schema to their own experience. The experimenters found five primary image schemas associated with subjects' sense of standing: BALANCE, VERTICALITY, CENTER-PERIPHERY, RESISTANCE, and LINKAGE. Second, subjects were asked to judge the similarity for thirty-five different senses of *stand*, sorting them into 5 groups. The experimenters found that subjects did not separate physical senses of *stand* from nonphysical or figurative senses, grouping *stand at attention* with *to stand the test of time*, for example. Third, after another activity period associated with their bodily experiences of standing, subjects were presented with verbal descriptions of the five image schemas, shown a list of thirty-two senses of *stand* and asked to rate the relevance of each image schema to each sense. From their responses, the experimenters constructed an 'image-schematic profile' for each of the 32 uses of stand, with *it stands to reason* and *as the matter now stands* having the same profile of LINKAGE – BALANCE – CENTER-PERIPHERY– RESISTANCE – VERTICALITY (in order of importance). In contrast, *don't stand for such treatment* and *to stand against great odds* exhibit the profile of RESISTANCE – CENTER-PERIPHERY – LINKAGE – BALANCE – VERTICALITY. In both profiles, the least relevant schema for each use was VERTICALITY, which linguists conducting *post hoc* analysis would likely mark as a primary image schema of *stand*. On the other hand, data showing VERTICALITY as the primary image correlated with expressions not typically associated with this schema, like *the barometer stands at 30 centimeters* or *got stood up for a date*. The data also showed a strong correlation between VERTICALITY and BALANCE as the two most salient profiled schemas in expressions where the subject is a single intentional agent (e.g., *He stands at attention*), and a strong correlation between VERTICALITY and some other image schema, such as CENTER-PERIPHERY, in cases of collective subjects (e.g, *standing ovation*) or artifacts with no moving parts (e.g., *house*). Importantly, subjects did not sort by context, suggesting to the experimenters that similarity of situation did not factor as a primary means of categorizing instances.

4.2. Cognitive Development and Language Acquisition

Infants use image schemas to generalize across perception and find commonalities of experiences. This is the principal claim staked out by Mandler (1992) and supported by Gibbs and Colston (1995).

Gibbs and Colston argue that the transformation of LANDMARK – BLOCKAGE – REMOVAL OF BLOCKAGE back to LANDMARK subtend a 4.5-month-old's demonstration of object permanence, whereas 3.5-month-old children do not demonstrate such a capacity. "One could argue," write Gibbs and Colston, "that development of the notion of object permanence can be thought of as the development of several different image schemas, and the workings of transformations between them" (1995: 367)

Infants as young as four months can distinguish between caused motion and self-motion with experiments of subjects observing one ball hitting another ball, causing the second ball to move, and experiments of subjects observing two balls moving independently of one another (Gibbs and Colston 1995: 365). The authors conclude that these infants employ a well-developed TRAJECTOR – PATH image schema within a trajectory schema transformation, such that the end point of the first trajector becomes the starting point of the second trajector. When this pattern does not appear, the ensuing motion of the second trajector is understood in terms of self-motion rather than caused motion.

Another set of findings that has implications for image schema theory is synaesthesia experiments conducted by Wagner et al. (1981). For this study, they paired perceptual events that share no physical features or history of co-occurrence, such as visual markings and musical tones. For example, 1-year-olds looked longer at dotted lines than at solid lines when presented with a pulsing tone. Likewise, they looked longer at a downward arrow when presented with a descending tone than with an ascending tone and vice versa. They also found that children as young as four already conceive similarities between pitch and brightness and between loudness and brightness.

For human beings to have meaningful experiences, conclude Gibbs and Colston (1995: 370), regular patterns of action and perception must develop early in development. The empirical evidence so far suggests that young children possess the ability to discover abstract relations among a diverse range of sensory perceptual events consistent with the general description of image schemas.

While Gibbs and Colston focus attention on the bodily origin of image schemas, more recent studies of language acquisition focuses more attention on the manipulation of objects in a material culture. Certainly Johnson and Lakoff, both collectively and individually, acknowledge the importance of varying social environments to cognitive and linguistic development. Indeed, Gibbs and Colston acknowledge that infants are born into a world which allows them to readily observe simple acts of containment, as would be afforded through cups, bottles, and dishes, which they readily see objects and substances disappear into and reappear out of. Thus, in their words, "it might be easier to analyze the sight of milk going in and out of a cup than milk going in and out of one's mouth" (1995: 366). Their suggestion that artifacts in material culture may, in fact, constitute the material substrate for the development of notions of CONTAINMENT means that comparative studies of differing social environments should enjoy greater attention of cognitive linguists.

Cross-linguistic research in first language acquisition epitomized by Sinha and Jensen de López (2000) calls on cognitive linguists to rethink just where image schemas come from. The authors argue against a strong version of the embodiment hypothesis, which states that bodily experience structures most if not all psychological and interpersonal domains through metaphorical projection. Their studies of English-acquiring, Danish-acquiring, and Zapotec-acquiring children as they acquire and use locatives, and tests using language comprehension and action imitation tasks, suggest an equally strong role for sociocultural context in

cognitive development. The Zapotec language, for instance, exhibits no morphological distinction between the nominal English equivalent to *stomach* and its locatives meaning 'in' or 'under'. English and Danish, on the other hand, distinguish *in* from *under*, and acquisition patterns and experiments suggest that there exists a definite bias among English- and Danish-acquiring children in favor of using *in* for good examples of CONTAINMENT and towards regarding *under* as a special case—implying occlusion and immobility but without implying complete enclosure. Zapotec-acquiring children, on the other hand, evince no '*in*-bias' in their use of locatives.

As the history of the Zapotec language attests, the role of the human body is a salient source for linguistic concepts, as is evidenced by the fact that body-part terms acquire locative functions. However, this may be an historical effect of indirect cognitive consequence, for Sinha and Jensen de López's study suggests that it is not only bodily experience which is the driving force for linguistic constructions of space and for the acquisition of spatial terms but also sociocultural context and the artifactual composition of cultural settings. Unlike Danish- and English-acquiring children, who, for the most part, are born into a world of richly diverse sets of artifacts, each of which perform highly specific functions, Zopatec-acquiring children grow up in material cultures with few artifacts, and, therefore, make use of them in more flexible ways. One salient artifact of containment in Zapotec cultures of southern Mexico is baskets. The child enters a world in which baskets are used as often to *cover something up* (e.g., tortillas, for storage, for catching chickens) as they are used to *place an object in*. The inverted orientation of the basket is a defining part of their material culture. In Zapotec culture, containment via baskets counts equally in its 'inverted' orientation (*under*) as it does in its canonical orientation (*in*) orientation. The same is not true for English or Danish speaking cultures.

Sinha and Jensen de López (2000: 20) tentatively attribute Zapotec-acquiring children not evincing the same *in*-bias in their responses as English-acquiring and Danish-acquiring children to the fact that baskets (the artifact used in all the experiments) are not used in the same canonical way. As such, there is evidence that containment may be universal but the diversity of nonlinguistic practices from one culture to the next brings about different conceptualizations of language reflected in the language acquisition process itself.

4.3. Image-Schematic Dimensions of Computational Modeling

If conceptual structure arises from spatial perceptual analysis of the immediate environment, as suggested above, then it may be possible to model such a learning process. Such is the aim of the Neural Theory of Language Project initiated by George Lakoff and Jerome Feldman. In this section, I will describe briefly some image-schematic features of this project and how they apply to specific models of language comprehension.

According to Bailey et al. (1997), current Neural Theory of Language projects begin with the representation of human-like actions. The computational feature representing action is the 'execution schema' (or x-schema), a representation of actions in an environment used to simulate specific execution patterns. For instance, one model enacts a DROP-schema in order to simulate the act of dropping an object; its components (or 'control transitions') include 'start', 'ongoing', 'finish', and 'done', where in the simulation 'start' binds with an agent supporting an object who then withdraws support. The removal of support triggers a FALL-schema, simulating the decreasing height of the object along a vertical trajectory until it hits the ground. These programs include static representations of the possible outcomes or consequences, known as a 'feature structures', of an x-schema. A feature structure (or 'f-

struct'), which, in turn, binds with, for instance, the DROP-schema produces the inference that the object will either bounce or break upon reaching the ground.

Although Bailey and his associates make no mention of the image-schematic characteristics of the DROP-schema/FALL-schema simulation, they would doubtless agree that these interlocking schemas exploit basic notions of RESTRAINT REMOVAL, SOURCE-PATH-GOAL, MOMENTUM, and VERTICALITY schemas.

Naryanan (1999) extends the same x-schema protocol to model metaphorical reasoning about political economy. For Narayanan, x-schemas connect source domain structures together in order to be mapped onto a target domain. For the mapping of the source domain of walking maps onto the target domain of liberal economy, this means, then, that x-schemas used to simulate walking combine to form the source domain for conceptualizing political economy (cf. Narayanan 1999: 1), as exemplified in the sentence, *While great strides were made in the first few years, the Government [of India] is currently stumbling in its efforts to implement the liberalization plan*. Implementation begins with a WALKING-schema and its components 'ready', 'start', 'ongoing', 'finish', and 'done'. At the point the program settles on the 'ongoing' component, it introduces the concept of 'bump', whereby the WALKING-schema is interrupted by a FALL-schema, integrating a different sort of 'start', 'ongoing', 'finish', and 'done' sequence, with 'done' binding to the VERTICALITY component 'down'. At this point, a GET UP-schema and its associated sequence of events runs concurrently with the STABILIZE-schema, complete with its own 'ready', 'start', 'ongoing', 'finish', and 'done' sequence. The source domain that will eventually structure information in the target domain implements x-schemas for WALK and FALL which run sequentially—the first interrupting the second—at the same time that it implements x-schemas for GET UP and STABILIZE, which run concurrently with each other and with the WALK-schema.

As with the previous example, the image-schematic character of these x-schemas can be made readily apparent. The most salient image schemas influencing the walking-stumbling domain would be SOURCE-PATH-GOAL, BALANCE, VERTICALITY, SURFACE, CONTACT, COUNTERFORCE, and ITERATION. To the extent that all x-schemas represent actions in the world, the SOURCE-PATH-GOAL schema is likely to be of fundamental importance when representing mobile agents. The BALANCE schema comes into play negatively with the notion of *stumble*, which implies CONTACT with an entity of COUNTERFORCE impeding forward progress. Since the intention is to keep going, the GET UP and STABILIZE schemas depend on our experiences of VERTICALITY relative to a landmark, and regaining of one's BALANCE allows the WALKING-schema to be resumed, thus experienced as an ITERATION of the same action.

Finally, consider in brief Terry Regier's (1996) computational model for categorizing spatial relations in English, Russian, and Mixtec. The program parses a movie of schematic trajector and landmark relations and judges each one as a poor or excellent example of English *through*, Russian *iz-pod*, or Mixtec *sini*. Principal computational features of this model include a specification for a beginning point, an end point, and an inferred trajectory between them. Computationally, the program matches a 'current buffer' with discrete snapshots of information in a 'motion buffer', an element of the program structured by a tripartite trajectory representation with three subrepresentations, each of which matches the image-schematic components of SOURCE-PATH-GOAL: a beginning representation, or the initial configuration of trajector relative to a landmark, an endpoint representation of the final static relation between trajector and landmark, and an integrated representation of a path running between the initial and final trajectors. The inspiration for Regier's SOURCE-PATH-GOAL-based program comes from studies of apparent motion. When presented with an object

displayed at one point in a visual field, then with a copy of the object at another point in a visual field, human subjects will perceive one object as moving from one point to the next.

5. Conclusion: A Few Issues of General Theoretical Importance

Consider once again the mundane activity of going and getting a library book, an activity with the image-schematic profile that includes our concepts of SOURCE-PATH-GOAL, CONTAINMENT, COLLECTION, PART-WHOLE, TRANSFER, and ITERATION. But why not stipulate the image schemas for BALANCE, COUNTERFORCE CONTACT, COMPULSION, and NEAR-FAR as equally a part of the profile? Surely one can imagine facets of this complex activity involving each of these schemas: walking entails BALANCE, opening the library doors entails COUNTERFORCE, transfer entails CONTACT, estimating one's progress along a path to a destination entails certain NEAR-FAR orientations, as so on. Therefore, should we conclude that my image-schematic profile is insufficient? Perhaps, but that only begs other questions, such as: What counts as an exhaustive image-schematic account of a familiar activity? Is there consensus on the exact number of image schemas? What are the constraints on postulating image schemas? At present, I see no widespread agreement on these matters, especially regarding the exact number of image schemas or even regarding the question whether some of the items appearing on Johnson's authoritative list, such as ENABLEMENT, are bona fide image schemas.

Adequate answers to the fundamental questions mentioned above have yet to appear. However, a suite of questions of a less fundamental nature do seem to have some promising answers that may help cognitive linguists answer these more fundamental questions. Some of these questions are: what properties are shared by the 'most important' image schemas and how can might they be grouped? Are there levels of schematization? How do noncognitive linguistic theories use image schemas? How might the graphic representation of image schemas influence linguistic analysis? This concluding section addresses briefly each of these issues. Perhaps we can regard some image schemas as more general and others as more specific. Cienki (1997), for instance, argues that PROCESS, PATH, OBJECT, and CONTAINER comprise known general schemas, each of which has a set of more specific schemas, such as STRAIGHT, SCALE, ITERATION, and CYCLE for PATH and FULL-EMPTY, SURFACE, and CENTER-PERIPHERY for CONTAINER.

Or perhaps we can group some according to criterion of 'super-imposability', whereby they can only be understood relative other image schemas. The CYCLE schema, for example, can be understood as the superimposition of a PATH whose GOAL and SOURCE are identical points in space due to ITERATION. This 'Gestalt' grouping of image schemas with other image schemas leads to the tentative conclusion that some image schemas are perceptually more primary (e.g., PATH) while others suggest a more complex structure; thus, distinguishing between recurring perceptual experience and gestalt complexes of perceptual experiences is crucial, despite their treatment as synonyms in much of the literature.

Distinguishing the developmental trajectory of image schemas may be another way of grouping them. Some image schemas may be developmentally more basic than others. According to Mandler (1992), conceptual development arises from perceptual analysis; by this mechanism, perceptual information is conceptualized, with the resulting notions of ANIMACY, INANIMACY, AGENCY, and CONTAINMENT guiding the initial phases of conceptual development. Image schemas for PATH, COMPULSION, LINK, COUNTERFORCE, CONTACT, SURFACE, and OBJECT may be ontogenetically basic, because each requires one ore more of these forms of perceptual analysis.

Now consider what known image schemas have in common.

All image schemas can be construed as dynamic or static scenes, as processes or states (see Cienki 1997, for a review). For example, we can construe the experience of BALANCE as a state of equilibrium or as an act of maintaining balance. The static versus dynamic characteristics of image schemas references Langacker's (1987: 145) distinction between summary and sequential scanning. When we construe a complex scene as one in which all facets are "conceived coexistent and simultaneously available," we are relying on static realizations of image schemas; then again, when we construe a complex scene as a series of states in which one successively transforms into another, we are relying on dynamic realizations of image schemas.

Kreszowski (1993: 310) discusses in some detail an important characteristic shared by all image schemas: the plus-minus parameter. That is, all image schemas exhibit a bipolar property of conferring positive or negative associations. In other words, image schemas all have euphoric or dysphoric characteristics, and it is this 'axiological parameter' that is "responsible for the dynamism of the metaphorization processes inherent in the formation of concepts based on the relevant schemata" (1993: 310). Thus, balance is positive/plus, while imbalance is negative/minus; whole is positive while part is negative. These euphoric and dysphoric properties are imperative for forming axiological concepts like 'good', 'beautiful', 'true', 'bad', 'ugly', and 'false' (1993: 325).

Even with these distinguishing and common features, image schemas seem to exhibit such a wide variety of instantiations that systematic investigation may seem impossible. This is where Kreitzer's study of schematization may come in handy.

Taking the case of *over* as his point of departure, Kreitzer (1997) distinguishes between three levels of schematization: the component level, the relational level, and the integrative level. The component level refers to particular schematized elements of a spatial scene, such as surfaces, lines, and points. They are geometrically schematic, allowing for an image schema to apply to a wide variety of objects and relations. For example, the SUPPORT and CONTACT schemas, realized linguistically by the preposition *on*, are schematized as points of a mass in contact with a surface. The relational level organizes components into specific spatial relations. The prototype for *over* requires motion and a trajectory traversing the boundaries of a landmark. This means that contact with the landmark is not relevant at the component or relational level of schematization. At the integrative level, multiple image schemas unite. Kreitzer gives the following example, taken from Lakoff (1987): *The city clouded over*. In this case, the PATH schema integrates with a static COVERING schema, but the crucial point is that the COVERING schema is not a part of the PATH schema at the relational level, for the construed relation is static not dynamic, hence no end-point focus transformation occurs (1997: 307). The main advantage of Kreitzer's levels is that it offers principled criteria for specifying different components of image schemas, with different lexical meanings arising from different integrations of relational schemas. For instance, *over* exhibits three different relational schemas: the first specifying a static relation along the vertical axis; a second specifying a dynamic relation along the vertical and horizontal axes, and a third specifying a static relation defined egocentrically. Kreitzer argues that the component level determines the basic primitives of spatial conceptualization.

The term 'spatial conceptualization' brings up an interesting issue regarding how image schemas are understood outside the cognitive linguistic community. Jackendoff's treatment of the 'linguistic-spatial interface' makes mention of image schemas as "abstract representations from which a variety of images can be generated" (1996: 9). In his scheme of representational modularity, Jackendoff places image schemas within the module of spatial representation, which is largely 'invisible' to conceptual structure. Strictly speaking, image

schemas are useful descriptions of spatial representation, providing three-dimensional models of spatial properties, but their influence on conceptual structure and linguistic structure are minimal. Jackendoff's theory of representation modularity is at once an acknowledgment of the power of image schemas as a theoretical notion, and a denial that image schemas play a significant role in conceptualization and grammar.

In addition, Jackendoff is quick to argue that "it is not obvious that places and paths are encoded in imagistic representation because we do not literally *see* them except when dotted lines are drawn in cartoons" (1996: 26). This seemingly off-handed remark, however, brings up an important issue regarding the graphic representation of image schemas, namely that these conventions may subtly channel cognitive linguistic investigations in ways that can bias theory and analysis in certain directions. This argument is made explicitly in Mandler (1992) and implicitly in Dewell (1994)

Diagrams for motion in notation systems for Cognitive Grammar usually include straight lines. But such a representation does not help us distinguish between animate motion, self-propelled motion, and inanimate and caused motion, distinctions that are essential for perceptual analysis, as outlined in Mandler (1992). The manner in which something traverses a path is an important, if unstated, element of image schema theory; that is, there are probably distinct schemas for animate and inanimate motion.

Dewell (1994) argues that typical accounts of *over* in Cognitive Linguistics posit several features, such as the shape of and contact with a landmark, as well as positing ACROSS and ABOVE as subschemas, which Dewell regards as separate schemas altogether. Although Dewell does not make this connection explicit, one can see that Lakoff's and Brugman's decision to make 'flat trajectory' examples of *over* the prototype stem, in part, from the tendency to represent trajectories as straight lines. But, as Dewell points out, the best linguistic evidence (e.g., *The dog jumped over the fence*) suggests that the most typical examples of *over* involve an ARCHED PATH schema, and from it he accounts for all the uses of *over* without specifying extraneous features, such as 'contact'. ACROSS and ABOVE are not subschemas of *over* but distinct schemas with their own inference generating capacities and grammatical realizations. Close examination of Lakoff's (1987: 419) case study reveals that he builds his analysis around an initial 'above and across' representation, with an oval marked trajector placed along a straight dotted arrow which runs from left to right and is placed over a square marked landmark, and that all subsequent graphic representations and analyses issue from that basic representation. Dewell, on the other hand, builds his analysis around a semicircular path with an arched arrow partially enclosing a rectangle (1994: 355). To summarize, graphic conventions of many image schema-based studies represent motion in a straight line as the default prototype, but as Mandler and Dewell argue, motion and paths are not prototypically straight. It is open for debate as to how the conventions of image-schematic representations actually bias theory and analysis. These two studies at least hint that this is an issue, as are the others mentioned above, that is worth our attention.

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