What's in a schema?
Bodily mimesis and the grounding of language

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> Mimetic skills or mimesis rests on the ability to produce conscious, self-initiated, representational acts that are intentional but not linguistic. Merlin Donald, *Origins of the Modern Mind*

Abstract

The chapter defines *mimetic schemas* as dynamic, concrete and preverbal representations, involving the body image, which are accessible to consciousness, and pre-reflectively shared in a community. Mimetic schemas derive from a uniquely human capacity for *bodily mimesis* (Donald 1991; Zlatev, Persson and Gärdenfors 2005) and are argued to play a key role in language acquisition, language evolution and the linking of phenomenal experience and shared meaning. In this sense they are suggested to provide a "grounding" of language which is more adequate than that of image schemas. By comparing the two concepts along six different dimensions: representation, accessibility to consciousness, level of abstractness, dynamicity, sensory modality and (inter)subjectivity the term "image schema" is shown to be highly polysemous, which is problematic for a concept that purports to be foundational within Cognitive Linguistics.

Keywords: bodily mimesis, consciousness, "grounding", intersubjectivity, mimetic schemas, representation, language acquisition.

1. Introduction

The concept of image schema is central to Cognitive Linguistics, as demonstrated by the contributions to this volume. At the same time, there is little agreement on the exact nature of the phenomenon that it should apply to. While some define image schemas as representational structures (Lakoff 1987; Grady, *this volume*; Mandler 2004, *this volume*), others emphasize

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their non-representational, "interactional" character (Zlatev 1997; Johnson and Rohrer, in press; Johnson, *this volume*; Gibbs, *this volume*). Some see them as part of the "Cognitive Unconscious" (Lakoff and Johnson 1999; Johnson, *this volume*), but others claim that image schemas possess phenomenal contours and hence cannot be completely unconscious (Gibbs, *this volume*). Most often image schemas are thought to be rather abstract structures such as PATH and VERTICALITY (Johnson 1987; Mandler 2004), or even more abstract ones such as CYCLE and PROCESS (Johnson 1987; see also the survey in Grady, *this volume*). On the other hand, "basic level" experiential structures such as PUSH and GRASP are sometimes given as illustrations of image-schematic structure (Gibbs, *this volume*). Finally, even their "embodied" nature, in the sense of being based on physical experience, has been questioned in some definitions (Clausner and Croft 1999), while Grady (*this volume*) argues for limiting the notion strictly to sensorimotor experience.

Clearly, image schemas cannot have all of these properties at the same time, and consequently we have not one but a number of different, more or less overlapping concepts: the term "image schema" is therefore highly polysemous. While polysemy may be a central characteristic of language, it is hardly a desirable property for a *scientific* concept, which furthermore is supposed to be foundational within Cognitive Linguistics. If there is one core feature that all the different "senses" of the term share, it is that image schemas should provide *a ground for linguistic meaning* – including, for some authors, even grammar (Lakoff 1987; Deane 1994). But of course, the manner in which image schemas are supposed to "ground" language depends on how the concept is defined in the first place.

Instead of adding one more sense to the term "image schema", I will employ a related, but distinct concept, namely that of *mimetic schema*. My goal in this chapter will be twofold: First, I will show how my concept compares to the different definitions of image schemas proposed in the literature along six different "parameters", two of which are also discussed by (Grady, *this volume*). Second, I will explicate and explore some of the evidence for the hypothesis that *linguistic meaning is grounded in mimetic schemas*. The realization of these two goals gives rise to the inference that mimetic schemas provide an alternative (and arguably better) account of what image schemas were designed to do: explain the possibility for linguistic meaning to arise. The presented analysis also has implications for the nature of image schemas of the more abstract type, e.g., CONTAINMENT, that are similar to those suggested by Dewell (*this volume*): Rather than being prior to and

independent of language as claimed by, e.g., Dodge and Lakoff (*this volume*), they are largely constituted by language itself.

2. Bodily mimesis and mimetic schemas

Over the past three years, I have carried out research within an interdisciplinary group of linguists, semioticians, cognitive scientists and philosophers in which we have studied the interrelationship between language, gestures and pictures in a phylogenetic and ontogenetic perspective.[1] A key concept in our project has been that of *bodily mimesis*, particularly in the manner explicated by Donald (1991), presented summarily in the chapter motto. We have proceeded to elaborate the concept, and at the same time relate it to similar theoretical proposals such as Piaget's ([1945] 1962) concept of *symbol* and Tomasello's (1999) notion of *imitative learning*. While our research has been collaborative, I will in the following express my individual take on the story, so my colleagues should not be held responsible for my, possibly controversial, statements.

The key notion can be defined as follows: A particular bodily act of cognition or communication is an act of *bodily mimesis* if and only if:

(i) it involves a cross-modal mapping between proprioception (kinaesthetic experience) and exteroception (normally dominated by vision), unless proprioception is compromised (*cross-modality*).
(ii) it consists of a bodily motion that is, or can be, under conscious control (*volition*).
(iii) the body (part) and its motion correspond – either iconically or indexically – to some action, object or event, but at the same time are differentiated from it by the subject (*representation*).
(iv) the subject intends the act to stand for some action, object, or event for an addressee (*communicative sign function*).

But it is not an act of bodily mimesis if:

(v) the act is fully conventional, i.e., a part of mutual knowledge, and breaks up (semi)compositionally into meaningful sub-acts that systematically relate to other similar acts (*symbolicity*).

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1. For a description of our project (mostly in Swedish), see <www.arthist.lu.se/kultsem/pro/sgb.html>.

While this definition is formulated as a "classical" list of necessary and (jointly) sufficient conditions, it allows for a stage-like interpretation that can be seen in an evolutionary perspective that we call the *mimesis hierarchy*. Acts which only fulfill the first condition, but not the others can be defined as *proto-mimetic*. Neonatal face-mirroring and cross-modal matching (Meltzoff and Moore 1977, 1983, 1994) can be regarded as such, and these have been witnessed in newborn chimpanzees as well (Myowa-Yamakoshi et al. 2003). On the other hand, both *deferred imitation* and *mirror self-recognition* fulfill conditions (i)-(iii) and thus show a full form of bodily mimesis. However, if condition (iv) is not fulfilled, it is bodily mimesis only of a *dyadic* sort. Skills such as these presuppose that the subject can both differentiate between his own (felt) bodily representation, and the entity that this representation corresponds to, and to see the first as standing for the latter. This is what Piaget (1962) called "the symbolic function", appearing at the end of the sensorimotor period of the child's development. Sonesson (1989, in press) uses this as the crucial criterion to distinguish between true signs, which display it, and pre-sign meanings, which do not. A recent review of the non-human primate evidence (Zlatev, Persson and Gärdenfors 2005a) shows that contrary to previously held views (e.g., Tomasello 1999), apes are capable of dyadic mimesis in the domains of imitation (e.g., do-as-I-do), intersubjectivity (e.g., shared attention) and gesture (e.g., imperative pointing). Therefore it is most likely that the common ape-human ancestor was also capable of dyadic mimesis.[2]

The crucial step in human evolution appears to involve (iv), or *triadic mimesis*, such as that involved in *pantomime* or *declarative pointing*, which has not been clearly demonstrated in apes in natural environments or even zoos. However, "enculturated" or "cross-fostered" apes, including chimpanzees (Fouts 1973), gorillas (Patterson 1980), an orangutan (Miles 1990) and bonobos (Savage-Rumbough and Lewin 1994) have shown that when provided with a high degree of social interaction involving intentional communication, the communicative sign function is not completely beyond the grasp of our nearest relatives in the animal kingdom. These findings can be taken as supporting Donald's (1991) original proposal of an intermediary mimetic

2. Note that our distinction between dyadic and triadic mimesis is not identical with Tomasello's (1999) notions of dyadic/triadic engagements: we classify e.g. imperative pointing as dyadic mimesis since it does not involve communicative intentions, even though there are three entities in the scene. On the other hand, we treat e.g. pantomime as triadic mimesis, even if it only depicts the (desired) actions of mimer and interpreter, i.e., a "dyadic" engagement.

stage in hominid evolution, approximately coinciding with the high days of *Homo erectus/ergaster* between 2 million and 500,000 years ago (with one descendant, the recently discovered *Homo floresiensis*, possibly surviving until as late as 18,000 years ago).

Finally, condition (v) distinguishes between intentional gestural communication, and *signed language*, which also possesses the properties of conventionality and systematicity (Singleton, Goldwin-Meadow and McNeill 1995). Some have proposed that such a *post-mimetic* stage, utilizing the manual-brachial rather than the vocal modality, intervened in hominid evolution (Stokoe 2001; Corballis 2002). Their claim is, in other words, that our ancestors initially communicated in a (simple) signed language, prior to vocal language taking the upper hand in hearing populations. However, the evidence does not require such a strong view, and the findings that have been marshaled in its support, e.g., the ubiquity of co-speech gestures (McNeill 1992), or the homology between Broca's area and areas of the monkey's pre-motor cortex controlling motor skills, and even their recognition in conspecifics using "mirror neurons" (Rizzolatti and Arbib 1998; Arbib 2003), can also be explained assuming a stage of triadic bodily mimesis, lacking full conventionality and systematicity.

While bodily mimesis, both in its dyadic and even more so in its triadic forms, is an essentially interpersonal phenomenon, it can also be *internalized* and used for thought, as argued by Piaget (1962) making the concept rather "Vygotskyan", in the sense of the general principle of the *inter*personal preceding the *intra*personal (Vygotsky 1978). But internalized, or what we might call *covert* mimesis, corresponds to what has recently been discussed in terms of "mental simulation" (Barsalou 1999; Gallese 2003; Gibbs, *this volume*; Rohrer, *this volume*). The major difference is that simulation is most often described as an unconscious, "neural" process (Dodge and Lakoff, *this volume*; Gallese and Lakoff 2005), while in our account all but proto-mimesis is at least potentially conscious. Notice also that the concept of "representation" used in our account (cf. also Ikegami and Zlatev, in press) presupposes a differentiation between expression and content, or mental image and (perceptual) reality *from the standpoint of the subject* (Piaget 1962), implying conscious awareness of the representation as such.

Given this characterization of bodily mimesis, mimetic schemas can be defined as *categories of acts of overt or covert bodily mimesis*. Examples of mimetic schemas are so-called action concepts, such as EAT, SIT, KISS, HIT, PUT IN, TAKE OUT, RUN, CRAWL, FLY, FALL, etc., which represent everyday actions and events. Let us summarize their properties.

(i) Mimetic schemas are *bodily* – in the very literal sense of the word, (usually) involving proprioception even if the action is "simulated" rather than actually re-enacted.
(ii) Mimetic schemas are *representational* – "running" the schema (either in reality or in imagination) is differentiated from the object, action or event to which is corresponds, "from the standpoint of the subject".
(iii) Mimetic schemas are *dynamic* – again in the literal sense of involving motion in both expression and content.
(iv) Mimetic schemas are *accessible to consciousness* – even though it need not be a matter of focal consciousness, which in the case of signs is directed at the represented rather than at the representation itself (Sonesson in press). Even so, mimetic schemas would qualify as structures of marginal consciousness (Gerwitsch 1964) rather than the "Cognitive Unconscious" (Lakoff and Johnson 1999).
(v) Mimetic schemas are *specific* – each one is a generalization of a particular bodily *act*, even if this act is carried out in the imagination rather than actually performed.
(vi) Mimetic schemas are, or at least can be, *pre-reflectively shared* – since they derive from imitating culturally salient actions and objects, both their representational and experiential content can be "shared" by the members of the community.

As we will see in the next section, most of these properties have been adopted within at least *some* account of image schemas. No account has, to my knowledge, included all of these properties, making the notion of mimetic schema a novel concept.

3. Mimetic schemas vs. image schemas

It is not my goal here to argue against image schemas and in their place try to sell my concept of mimetic schema. Rather, my concern is with explicating the essential features of mimetic schemas. In the process of doing so, I will show that these features contrast with some characterizations of image schemas, but not with others. Thus, these properties and their contrasts can be seen as values along parameters along which different accounts of (image) schemas vary. While I will urge for a particular set of values along these parameters, I do not mean to exclude other possible sets: These other kinds of (image) schemas may have theoretical value in cognitive science and Cognitive Linguistics, but (a) they are not mimetic schemas, and (b)

their role is less directly related to providing a ground for language. I will not argue for this second statement explicitly, but will try to show that mimetic schemas are more consistent with both empirical evidence and conceptual considerations concerning the nature of language. At the same time, if the reader would agree with my attribution of values along the following six dimensions, but insist on the term "image schema", then I would reply: "What's in a name?"

3.1. Representation

While the notion of *mental representation* was the most fundamental concept of "classical" cognitive science (e.g., Fodor 1981), "second generation" cognitive science of the 1990s (e.g., Varela, Thompson and Rosch 1991) witnessed a justified reaction against the overuse of the term, relying on such notions as *embodiment* (cf. Ziemke, Zlatev and Frank, in press) and *interaction*. Some image schema theorists adopt such an anti-representationalist stance explicitly:

> As we said in *Philosophy in the Flesh*, the only workable theory of representations is one in which a representation is a flexible pattern of organism-environment interactions, and not some inner mental entity that somehow gets hooked up with parts of the external world by a strange relation called 'reference'. (Johnson and Lakoff 2002: 249-250)

But redefining "representation" as "interaction" is a bit too strong. Admittedly, much of animal and (even) human cognition is non-representational, in the sense of "representation" used by Piaget ([1945] 1962) and adopted in the definition of mimetic schemas in Section 2. But is (drawing) a picture of an apple an "interaction" with it of the same kind as eating it? Furthermore, if we adopt a characterization of image schemas as non-representational structures, as stated explicitly by Johnson and Rohrer (in press), image schemas become structures of general animal sensorimotor cognition, and are in no way specific to human beings:

> Image schemas are thus part of our non-representational coupling with our world, just as barn owls and squirrel monkeys have image schemas that define their types of sensorimotor experience.

Johnson (*this volume*) similarly defines image schemas as "structures of sensory-motor experience" and Gibbs' (*this volume*) characterization as "attractors within human self-organizing systems" appears to be similar, at

least in this respect.[3] In previous work (Zlatev 1997), I also urged for an interpretation of image schemas as *sensorimotor schemas* in the sense of Piaget (1952): goal-directed structures of practical activity, emerging from the child's physical interaction with the environment.

However, there is a serious problem for these accounts to the extent that they purport to provide an explanation of (the rise of) language. Sensorimotor schemas are non-representational, while language *is* representational in two different, though related, respects: it has expression-content structure and statements are *about* states of affairs, they have what Searle (1999) refers to as a "mind-to-world direction of fit" (cf. Zlatev, in press).

Piaget was very much aware of this problem, and while he argued that sensorimotor structures play an important part in the "construction of reality for the child", he also claimed that they have inherent limitations:

> … sensorimotor activity involves accommodation only to present data, and assimilation only in the unconscious practical form of application of earlier schemas to present data. (Piaget 1962: 278)

Therefore Piaget distinguished between sensorimotor schemas and what he referred to as *symbols.* The latter emerge at the end of the sensorimotor period and serve as a prerequisite to the learning of linguistic *signs*. However, Piaget's term "symbol" is confusing (to the modern reader) since what it refers to is neither *conventional,* nor interconnected in a *system.*[4] In fact, Piaget's account of "symbol" is very close, if not identical to that of mimetic schema: both emerge through imitation, but can be internalized as a form of mental simulation. Several accounts of image schemas presented in this volume, most notably that of Gibbs (*this volume*), likewise regard these as simulations: "simulators of action that are based on real-life actions and potential actions that a person may engage in". But the notion of simulation begs the question: simulation of *what*?

Other accounts of image schemas (Grady, *this volume*; Mandler 2004, *this volume*) are more explicitly representational:

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3. Notice, however, that Gibbs (*this volume*) inserts the adjective "human" and later on urges that image schemas "should not be reduced to sensorimotor activity", which is also true of mimetic schemas. He also refers to image schemas as "simulators" and "simulations", which would appear to make his notion of image schemas representational anyway.
4. These influential characterizations of symbols, which I have argued should be combined (Zlatev 2003b), were made by Peirce (1931-1935) and Deacon (1997), respectively.

> Image-schemas, such as SELF-MOTION, form the earliest meanings that the mind represents. … This representational system creates a conceptual system that is potentially accessible; that is, it contains the information that is used to form images, to recall, and eventually to plan. (Mandler 2004: 91).

Mimetic schemas are thus in accordance with accounts of image schemas which treat the latter as representational structures, but not with those which treat them as (merely) sensorimotor, "interactional" structures, and even less so with those which treat them as neural structures (Rohrer, *this volume*; Dodge and Lakoff, *this volume*), since in themselves neurons, or even "neural circuits" do not stand for anything.[5]

3.2. Consciousness

Mimetic schemas are recurrent acts of bodily mimesis, and since mimesis rests on consciousness (Donald 1991), mimetic schemas are structures of consciousness. The notion of "consciousness" is of course vexed with riddles, but since consciousness became again a (scientifically) respectable topic over the last 20 years,[6] considerable advances have been made in both philosophical discussions, e.g., of the "hard problem" of the irreducibility of qualitative experience (Chalmers 1996), in distinguishing between different kind of consciousness, e.g., *affective* from *reflective* consciousness, as well as in understanding the neural underpinnings of this often mysterious phenomenon (e.g., Edelman 1992; Damasio 2001). In this respect, Cognitive Linguistics, with some notable recent exceptions (e.g., Talmy 2000; Evans 2003), is lagging behind, and (usually) shying away from referring to consciousness as an *explanans* for linguistic meaning and structure. Instead, the bedrocks of language, including image schemas, are sought in problematic

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5. Dodge and Lakoff (*this volume*) appeal to the work of Regier (1996) in seeking a neural basis for image schemas, but I would argue that this is misguided. Regier does not interpret his model as an implementation of image schemas and repeatedly points out that it is only inspired by some properties of nervous systems, as well as by "high level" structures such as Source, Path and Goal, deriving from linguistic analysis. For a very different interpretation and a minor modification of Regier's model, see Zlatev (1997, 2003a).
6. As testified by a number of journals including *Journal of Consciousness Studies*, *Consciousness and Cognition*, and *PSYCHE: An Interdisciplinary Journal of Research on Consciousness*, as well as annual conferences such as "Towards a Science of Consciousness" (TSC).

notions (cf. Zlatev, in press) such as the "Cognitive Unconscious", characterized as "completely and irrevocably inaccessible to direct conscious introspection" (Johnson and Lakoff 1999: 103).

Johnson (*this volume*), however, is considerably more careful in pointing out that structures such as image schemas "*typically* operate beneath the level of our conscious awareness" [my emphasis], which does not imply that they are inaccessible. In an even stronger departure from earlier formulations, he admits that, by regarding image schemas as (unconscious) structures,

> … you lose, or at least overlook, the very thing that gives image schemas their life, motivating force, and relevance to human meaning, namely, their embeddedness within affect-laden and value-laden experience.

But this is nothing else but an aspect of affective consciousness, and thus of "phenomenological embodiment" (Lakoff and Johnson 1999), rather than the Cognitive Unconscious. Gibbs' (*this volume*) remark that an image schema is a "simulator [that] provides something close to what it actually feels like in a full-bodied manner" similarly includes a reference to phenomenology. Lakoff, on the other hand, seems to be moving in the opposite direction and seeking not just neural substrates, which is a justified scientific enterprise, but actually "viewing image schemas as neural circuits" (Dodge and Lakoff, *this volume*). This is another matter, both philosophically and empirically, as it is not my hippocampus that sees or feels an object moving along a path to a landmark, I do. The argument that "linguistic structure is below the level of consciousness because the brain structures that compute them are unconscious" (Dodge and Lakoff, *this volume*) is, metaphorically speaking, a (conceptual) *short*-circuit.

Whereas Johnson (*this volume*) worries that "there may be no way around this problem", i.e., of how to include (affective) consciousness into image-schematic structure, I would venture to claim that the problem does not even appear with respect to mimetic schemas. This is so, firstly, because mimetic schemas exist at the level of specific real or imagined bodily actions. Since they are by their nature *experiential* structures, each mimetic schema has a different emotional-proprioceptive "feel", or affective tone (Thompson 2001) to it. Consider, for example, the affective contrast between the mimetic schemas X-KICK-Y and X-KISS-Y. In this way they capture what Johnson (*this volume*) refers to as "the flesh and blood of meaning".

Secondly, since mimetic schemas can be decoupled from perception and actual action, they can be used in imagination, and thus become an aspect of *reflective* consciousness. This makes them "accessible" in Mandler's terms

(2004, *this volume*), which is a property that she considers definitional of *concepts*. On the other hand, Mandler (*this volume*) also points out that image schemas "are not themselves accessible", i.e., conscious, but that is because she considers image schemas a representational "format" that gives rise to specific content, the latter being consciously accessible. It appears that she envisages image schemas to be part of an innate mechanism called "perceptual meaning analysis", which "extracts the spatial and movement structure of events in image-schematic form to represent them". Thus, there seems to be another parameter along which image schema accounts differ: bottom-up, "empiricist" accounts starting with actual full-blooded experience such as those of Johnson and Gibbs (in affinity with mimetic schemas) and top-down, "rationalist" accounts such as Mandler's and Lakoff's. This is, however, closely related to the next dimension, so I will not discuss it separately.

3.3. Level of abstractness

In the Cognitive Linguistics literature there has been some considerable debate concerning the level of abstractness of image schemas. In his contribution to this volume, Grady makes a set of valuable distinctions: there are at least three different levels of abstractness involved: (i) concrete schemas such as UP (HEIGHT), for which Grady reserves the designation "image schema", (ii) more abstract schemas such as MORE (QUANTITY), which Grady calls "response schemas" since he regards them as being the outcome of *primary metaphors* (Grady 1997), mappings from concrete domains due to correlations in experience in early childhood, and (iii) "superschemas" such as SCALAR PROPERTY, which capture the shared structure between (i) and (ii), guaranteeing a degree of isomorphism or "invariance" (Lakoff 1990). This hierarchy is very useful, but Grady fails to specify the nature and origin of such superschemas serving as constraints on metaphorical mappings. In a complementary contribution, Dewell (*this volume*) argues that schemas such as CONTAINMENT, and I would add UP, are not "purely preverbal" but rather shaped by language itself due to:

> … the influence of language generally toward maximally precise and differentiated linear shapes that can be explicitly profiled and publicly accessed from a flexible perspective.

I am in general agreement with both of these accounts, and furthermore believe that the approach endorsed in the present chapter can help provide a

synthesis. Mimetic schemas such as CLIMB and JUMP are (at least) one level below Grady's image schemas (of the HEIGHT and PROXIMITY type). Similar to Johnson (1987, *this volume*), I consider the latter to be formed in part *inductively*, i.e., by extracting generalizations over shared features of particular mimetic schemas, e.g. both CLIMB and JUMP involve motion along a VERTICAL dimension. But such generalizations are hardly formed purely "pre-verbally". First there is the famous "problem of induction" (Hume [1739] 2000). Concerning the present example: why generalize on the basis of verticality rather than some other "dimension", e.g., using both hands/feet? If, on the other hand, the child is simultaneously exposed to the morpheme *up* or *down* in conjunction with actions involving motions in the corresponding direction, then this generalization would be facilitated. This is exactly what Regier's (1996) connectionist model requires in order to converge on the corresponding "image schema" (see note 2 above, concerning the contrary interpretations of Regier's model). On the other hand, if the child is exposed to the verbs *kkita* and *nehta*, then (s)he will learn to discriminate TIGHT FIT from LOOSE FIT, as is the case in Korean (Choi and Bowerman 1991; Bowerman 1996), and it has been shown that Korean adults do, but adult English speakers do not make conceptual distinctions on the basis of the dimension 'tightness-of-fit' (Mandler 2004, *this volume*). This implies that, contrary to the most common view, "image schemas" of the kind most often discussed in the literature do *not* "exist independently of the linguistic forms used to express them" (Dodge and Lakoff, *this volume*). In the terms introduced in Section 2, such schemas are symbolic, i.e., conventional and systematic, and thus post-mimetic.

Further evidence for this possibly controversial analysis comes from studies of the spontaneous emergence of Nicaraguan Sign Language (NSL) during the past 25 years. Senghas, Kita, and Özyürek (2004) compared the co-speech gestures of Nicaraguan speakers of Spanish, with the signing of three "cohorts", or generations, of learners of NSL and documented the emergence of the differentiation between MANNER and PATH along with the emergence of the language: the more fluent the signers were in NSL, the more likely they were to express these as separate units in communication. Since this concerns "schemas" that are very dear to cognitive linguists, and whose apparently universal expression in separate units of language (Talmy 2000, Vol I: 21-146) is often given as evidence of their "preverbal" and in some cases even "neural" nature, I quote the analysis of Senghas, Kita, and Özyürek (2004: 1781) at length:

> The movements of the hands and body in the sign language are clearly derived from a gestural source. Nonetheless, the analyses reveal a qualitative difference between gesturing and signing. In gesture, manner and path were integrated by expressing them simultaneously and holistically, the way they occur in the motion [event] itself. Despite this analogue, holistic nature of the gesturing that surrounded them, the first cohort of children, who started building NSL in the late 1970s, evidently introduced the possibility of dissecting out manner and path and assembling them into a sequence of elemental units. As second and third cohorts learned the language in the mid 1980s and 1990s, they rapidly made this segmented, sequenced construction the preferred means of expressing motion events. NSL thus quickly acquired the discrete, combinatorial nature that is the hallmark of language.

This passage illustrates very clearly the transition from iconic gestures, which can be regarded as fairly transparent externalizations of mimetic schemas, to "discrete, combinatorial" cognition, which has its origin in language (e.g., Tomasello 1999). Thus, image schemas even of the most concrete type in Grady's hierarchy cannot provide a ground for language, since they are themselves constituted by it. Mimetic schemas, on the other hand, can, since they correspond to much more concrete actions and events. This conclusion is bound to be resisted since it goes against a prevalent assumption within Cognitive Linguistics concerning the "non-verbal" nature of foundational concepts like image schemas and conceptual metaphor. But as Dewell's contribution to this volume testifies, the belief in this assumption seems to be wearing off.

Why it is that language brings about the qualitative difference is itself a matter of heated controversy. Nativists of the generative tradition such as Siegal (2004: 9) have seen the NSL phenomenon as evidence for "the fundamental innateness of grammar", but Senghas, Kita and Özyürek (2004: 1782) prefer a scenario in which the first languages and children's learning abilities have co-evolved. It is also possible to seek more functional explanations, such as the "pressures to insure successful communication" (Dewell, *this volume*).

To return to Grady's (*this volume*) hierarchy: if even the most concrete image schemas that he presents are language-based at least to some degree, there is even more reason to believe that this is also the case with the more abstract ones. "Superschemas", such as ONTOLOGICAL CATEGORY (EVENT, PROCESS, THING), SCALARITY/DIMENSIONALITY, ASPECT, BOUNDEDNESS, etc., are all reflected in the grammatical systems of the worlds' languages. Do we need to explain their universality on the basis of "preverbal" struc-

tures and processes as is customary in Cognitive Linguistics? I would argue not. As claimed by Heine and Kuteva (2002) grammaticalization processes can lead not only to language change, but to an increase in language complexity through the *evolution* of grammatical (and hence semantic) categories, though this itself challenges the dogma of language "uniformitarianism" (cf. Newmeyer 2003). If this is furthermore coupled with a co-evolutionary scenario in which children's learning abilities have themselves been changed/shaped over the millennia since the dawn of (proto)language, as suggested by Senghas, Kita, and Özyürek (2004), it would explain why Nicaraguan children constructed the representational categories (schemas) MANNER and PATH so easily when they created NSL.

As for the metaphorical "mapping" between image schemas and "response schemas", that can be naturally explained as deriving from (conscious) processes of *analogy* (Itkonen 2005), performed by speakers (and signers) under the constraints of the shared structure (the "superschemas") in the source and target domains. As suggested above, it is likely that this structure is induced in part by language itself.

In sum, mimetic schemas are relatively concrete, "analogue" and "holistic" representations. As such, they qualify for the adjective "pre-verbal", and are therefore a possible ground for language. The kind of structures that cognitive linguists have termed "image schemas" come in different levels of specificity, but to the extent that they constitute semantic primitives such as CONTAINMENT, PATH and MANNER, they are not a ground, but rather a product of language – in probably both phylogenetic and ontogenetic terms.

3.4. Dynamicity

At first glance, this parameter of variance is easier to deal with than the preceding three, since nearly all image schema theoreticians ascribe some form of "dynamicity" to the concept. One possible exception is Mandler (2004, *this volume*), who – when describing image schemas as a "format" for concepts – suggests some sort of "mold" in which experience is poured, and molds are static things. But that may be a (metaphorical) misinterpretation, since what leads to (consciously accessible) concepts for her is "perceptual meaning analysis", which is nothing but a process (see also Section 3.2). Still, Mandler (*this volume*) notes that "image-schemas are not iconic… An image-schema of PATH does not contain information about speed or direction." This would imply that Mandler's concept of PATH (and

other schemas) is a rather abstract structure which, contrary to her analysis, may be based on language rather than serving as a basis for it, as suggested above.

However, the issue of dynamicity is not so simple, as shown by Dewell (*this volume*), who argues that truly dynamic image schemas, in both "structure" and "content" have been rather "underappreciated" in the cognitive linguistic literature in the quest for semantic primitives such as CONTAINER. Dewell provides an analysis in which even such apparently static structures (usually given as meanings to prepositions such as *in*) are ontogenetically preceded by dynamic schemas such as ENTRY:

> It is much more likely that the earliest image schemas will involve activities and paths, with little clear differentiation between trajectors (TRs), landmarks (LMs) and relations, between paths and resulting states, or between space and time.

Mimetic schemas are likewise "dynamic in structure and content", but are in comparison still more undifferentiated, e.g., there is not yet any differentiation between "activity" and "path", as shown in iconic gestures. In contrast to Mandler's notion, mimetic schemas are highly *iconic* (or *indexical*) structures,[7] resembling the represented activity in not only speed and direction, but in the features GAIT, BODY PART and EFFORT, discussed by Dodge and Lakoff (*this volume*).

At the same time, since mimetic schemas are defined as "*categories of acts* of bodily mimesis", they are (expected to be) relatively stable and well-defined. This has two implications: (i) there is likely to be a relatively limited set of mimetic schemas within a cultural community – which is relevant for their capacity to be shared (see 3.6 below), and (ii) while they are not identical with verb meanings, mimetic schemas can serve as a likely candidate to ground the latter in ontogeny.

In an analysis of the "first verbs" of a child acquiring English, Tomasello (1992) classifies the motion predicates acquired by the child during the period from 16 to 24 months, i.e., the period of the "vocabulary explosion", as shown in Table 1. During her first 8 months of (productive) language acquisition the child learned a total of 84 verbs denoting activities involving different forms of bodily motion (see the first two rows of Table 1). *Each one of these can be taken to correspond to a mimetic schema.* Contrasting with

7. The various forms of pointing found in different cultures, e.g. with the index finger, the whole hand, with the mouth, may be regarded as realizing *indexical* mimetic schemas.

these are 17 other "verbs" expressing more schematic relations, of the type that would presumably involve image schemas such as UP and CONTAINMENT.[8] While some of the latter were also acquired very early, one can notice that all of them form contrastive pairs: *move/stay (stuck), go/come, put/get-out, bring/take, up/down, on/off, in/out, over/under, here/there*. This is further evidence for the hypothesis that language itself played a crucial role for their differentiation, as opposed to assuming that the expressions are just "labels" being mapped to "pre-existing schemas".[9] No such contrasts are discernable in the activity verbs.

Category	*Examples*	*Total No.*
Activities with objects	sweep, cut, hammer, drive, kick…	48
Activities without objects	cry, pee-pee, jump, swim…	36
Change-of-state, focus on motion	move, stay, stuck, go, come, put, get-out, bring, take	9
Change-of-state, focus on goal	up, down, on, off, in, out, over, under, here, there	8

Table 1. Classification of the first motion predicates of a child during the period 16 to 24 months, based on data provided by Tomasello (1992: 187-221)

The conclusion, again, is that mimetic schemas, which are dynamic representations of everyday actions and events, are ontogenetically more basic than image schemas, even when the latter are taken as inherently dynamic structures.

3.5. Sensory modality

Image schemas are nearly always characterized as "bodily", but it is less often explained what this actually means, since "embodiment" is a highly ambiguous concept (cf. Ziemke, Zlatev and Frank, in press). If it only means that they are based on neural structures and functioning, a matter of "neural

8. The items in the fourth row were classified as verbs because the context of use showed that they involved motion, even though they are not verbs but prepositions/adverbial particles and deictic adverbs.
9. In Regier's (1996) model, such contrastive pairs or sets needed to be given to the model simultaneously so that the model could converge on its representations. Otherwise, it did not – unless presented with explicit "negative evidence" of the kind that children do not in general receive (e.g., Braine 1971).

embodiment" (Lakoff and Johnson 1999; Dodge and Lakoff, *this volume*; Rohrer, *this volume*), then their bodily status becomes rather trivial, since all mental functioning has the brain as a *sine qua non*. The alternative (or complementary) and more fruitful approach has been to regard the "embodiment" of image schemas as constituted by sensorimotor activity and experience (Johnson 1987, *this volume*). In previous work (Zlatev 1997) I argued that this makes them identical to Piaget's (1952) *sensorimotor schemata* – except that they are defined at a higher level of abstraction. Piaget's formulation in the preface to the second edition of *The Origins of Intelligence in Children* could well be taken from a publication by Mark Johnson, but surprisingly, Piaget is seldom given credit within Cognitive Linguistics:

> It is primarily preverbal sensorymotor activity that is responsible for the construction of a series of perceptual schemata, the importance of which in the subsequent structuring of thought cannot, without oversimplification, be denied. (Piaget 1952: 10)

Thus understood, image schemas are *cross-modal* (as apposed to amodal) structures, involving sensorimotor coordination. However, we need to probe deeper and ask: which modalities are *essential* for their formation. The first candidate is *vision*, which is plausible, given the relatively dominant role played by vision in the primate, and even more so human, brain (Watt 1991). Mandler (2004, *this volume*) argues that perceptual meaning analysis of visual data "provides the main route of our concept of physical force" and similarly for other image schemas. But if vision is so crucial, then blindness from birth should invariably lead to serious mental disfunctioning and this is not the case. In their detailed study of a blind child, Landau and Gleitman (1985) report only slight delays in cognitive development and language onset, but otherwise a completely normal developmental pattern in language acquisition. The child learned the meanings of words such as *see* and *look*, though she applied them differently for herself, referring to haptic exploration, and for her seeing parents, with apparently the same meanings as in English. So while vision is undoubtedly a very important source of experience for normal children, it cannot be a *necessary* ground for language. A key to the puzzle could be the fact that the child received extraordinary amounts of haptic and verbal interaction from her caregivers, which appeared to compensate the lack of vision.

Similarly, certain handicaps show that actual sensorimotor *activity* itself is not necessary for the development of intelligence, which presents problems

for Piaget's, as well as Mark Johnson's, emphasis on sensorimotor (image) schemas. Consider the episode recounted by Jordan (1972: 379-380):

> … while visiting an institution for the aged and incurable, I was attracted by a patient there: Her head was that of a normal adult – in the early 40s – but her body was that of a neonate – albeit about two to three times the size of a month old infant. Her arms and hands were 'absolutely' infantile. They stuck out from her body exactly as an infant's do, moving occasionally but showing no purpose whatsoever. … I asked about the patient and was told that she was one of the most popular and intelligent of the patients, serving as a regular discussion reader, and being of great help to both the other patients and the staff in filling out income tax returns.

Jordan concludes that this case poses a challange to Piaget's theory:

> Given the fact that the patient never used her body since birth and interpreting sensory-motor activity as action in and upon the environment, it follows that the patient never did engage in sensory-motor activity. Yet, the patient did exhibit a normal adult functioning intelligence. (Jordan 1972: 380)

Orthodox piagetians usually dismiss such objections by pointing out that even paralyzed patients can at least move their eyes, and that *sensorimotor activity* should be taken more generally, but this seems to water down the whole notion, distancing it from the "the flesh and blood of meaning". Some recent research (Riviére and Lècuyer 2002) conducted on children with spinal muscular atrophy (SMA), who are severely motorically impaired, shows that they do not differ in their performance on tasks involving spatial cognition compared to healthy controls.[10] Furthermore, such children display a normal IQ and language skills. Therefore if (a) image schemas, or for that part mimetic schemas, need to be acquired through *actual* physical experience, and (b) they are a necessary prerequisite for the development of (spatial) cognition and language, then patients with SMA would be expected to be at least linguistically retarded, if not impaired. Since this is not the case, logic tells us that either (a) or (b) must be retracted. Mandler's (largely) vision-based account would seem compatible with this perspective, but then it is problematic due to the results from blindness. I believe there is a way

10. In a follow-up study Riviére and Lècuyer (2003) even report significantly higher performance on a 3-location search task for SMA children compared to healthy controls, and interpret this in terms of better developed inhibitory mechanisms in the SMA children, allowing for a "more reflective approach to the problem" (Riviére and Lècuyer 2003: 290)

out by modifying, rather than abandoning statement (a), in a way showing that Jordan is wrong in claiming that the patient "never used her body since birth" in the final quotation.

Mimetic schemas in normal cases have their *origin* in a cross-modal mapping between exteroception (dominated by vision, unless there is blindness) and proprioception. However, in contrast to the way Gibbs (*this volume*) defines image schemas, mimetic schemas are not *exhausted* by proprioception, and if the latter would be compromised, then only protomimesis would be impossible, but not mimesis itself. Gallagher (2005: 37-38) argues that proprioception serves as the basis for the *body schema*: "a system of sensory-motor processes that constantly regulate posture and movement – processes that function without reflective awareness or the necessity of perceptual monitoring". Gallagher describes a patient who has lost tactile and proprioceptive input from the neck down, but can consciously control his movements, especially by visual guidance. In Gallagher's (2005: 37-38) analysis the patient performs this through the *body image*, which is "a (sometimes conscious) system of perceptions, attitudes, beliefs and dispositions pertaining to one's own body." The two systems normally interact, but can be doubly disassociated. From these definitions, it becomes clear that bodily mimesis, and thus mimetic schemas as *conscious, dynamic representations*, should be expected to utilize the body *image*, serving as a kind of *virtual* body rather than the pre-conscious body schema.

Returning to the patient described by Jordan (1972), it is fair to conclude that due to her handicap, she must have had a dysfunctional body schema. Nothing is, however, said about her body image, which also appears to correspond to the "mimetic controller" hypothesized by Donald (1991). Thus, she would still have been able to form mimetic schemas, albeit of the *covert* type. In other words, she would have been able to perform mental "simulations" of actions and events, matching these to the bodily motions of others, possibly through the often mentioned, but (still) not completely well understood "mirror neuron system" (e.g. Gallese, Keysers and Rizzolatti 2004). Observing the actions of others, she would have been able to "imitate" them in a covert way, making her mimetic schemas intersubjective in a way to be explicated below.

I am aware that this reply to the challenge to claims of necessity for any kind of body-based schemas (be they image, sensorimotor or mimetic schemas) provided by the mentioned clinical evidence is tentative. Nevertheless, since mimetic schemas are not sensorimotor structures but bodily concepts, it seems that they offer a promising way to reconcile the various sorts of

evidence. The meta-conclusion is that clinical evidence should be taken more seriously prior to postulating particular sensory modalities as necessary grounds for cognitive and linguistic development.

3.6. Intersubjective vs. private

The final dimension is one that unfortunately has received very little attention in the Cognitive Linguistics literature. Image schemas, as all forms of mental structures, are usually conceived as private, individual phenomena, irrespective of how they are treated otherwise. But this poses a problem if they are to serve as a ground for, or even constitute, linguistic meanings, since the latter are public, *conventional* entities (Clark 1996; Tomasello 1999; Itkonen 2003; Zlatev, in press). As clearly stated by Tomasello (1992: 215): "Linguistic symbols are social conventions that package cognition in a way that human beings have found useful for communication". The problem is both conceptual and empirical: Since 18-month-old children lack the metalinguistic capacity for establishing full-fledged conventions, which are structures of common knowledge (Lewis 1969), it remains a mystery how children move from the (private) sensorimotor to the symbolic (i.e., conventional and systematic) level to learn a language as a "socially shared symbolic system" (Nelson and Shaw 2002).

Mimetic schemas can help resolve this puzzle since they possess the property that Arbib (2003) calls "parity": they are, or at least can be, shared among the members of a community who engage in face-to-face (or rather body-to-body) interaction. In his theory of "the emergence of symbols", Piaget proposed that the latter crucially involve *imitation*. Piaget distinguished between three types of imitation, which form an epigenetic progression (i.e., a developmental sequence, where later forms necessarily build on earlier forms): (a) *sensorimotor imitation* – in which the model's action is imitated directly; (b) *deferred imitation* – in which the imitated action – either of another, or of oneself – is displaced in time; and (c) *representative imitation* – in which:

> … the interior image precedes the exterior gesture, which is thus a copy of an "internal model" that guarantees the connection between the real, but absent model, and the imitative reproduction of it. … Imitation, with the help of images, provides the essential system of "signifiers" for the purpose of individual or egocentric representation (Piaget 1962: 279-280).

As pointed out earlier, Piaget's "symbols" and "images" are practically identical with my concept of mimetic schemas. Piaget's characterization of such representations as "individual and egocentric" should not be taken to mean that they are *private*, since Piaget defines "egocentrism" as "failure to differentiate between the ego and the group, or confusion of the individual view-point and that of others (Piaget 1962: 290). In other words, it is more correct to say that mimetic schemas are *pre-reflectively shared* or perhaps *proto-conventional.* Since the child's mimetic schemas derive from imitating salient actions and events in the community, both their representational and experiential content will be "shared" with those of his caregivers and peers. In this way, they can serve as a bridge to developing true symbols, which are not just shared but known to be shared, i.e., post-mimetic.

This, however, could be taken to imply that children who cannot engage in imitation due to various sorts of motoric handicaps, such as the cases discussed in Section 3.5, will fail to develop mimetic schemas. Piaget's account of the origin of representations through imitation therefore needs to be modified. The *overt* sequence of sensorimotor-deferred-representative imitation cannot be a necessary epigenetic progression. What I earlier called *covert* imitation would be a way to resolve this impasse. The mirror neuron system of the child would presumably allow for this even in the absence of body movements, undergoing a developmental sequence similar to that proposed for the *evolution* of the mirror system by Rizzollati and Arbib (1998): from action recognition to (covert) imitation to representation, by decoupling the image and its content. Whether the *experiential* content of the mimetic schemas of motorically impaired children would differ from those of the rest of us is an interesting philosophical and empirical question to which I do not think there is any answer at present.

Finally, this account would correctly predict that children with autism, who in general do not imitate in an adequate manner despite full motoric proficiency will (whatever the underlying reason) fail to develop intersubjective mimetic schemas, and consequently will have various degrees of language impairment. This account is similar to that of Tomasello et al. (2005) who propose that children with autism, as well as non-human primates, fail to develop "dialogic cognitive representations". Zlatev, Persson and Gärdenfors (2005a,b) point out this similarity, and suggest that bodily mimesis and mimetic schemas can explain the nature of human cognitive specificity, being what allows (non-autistic) children to co-construct a world of meaning that is shared with their elders and peers.

4. Summary and conclusions

In this chapter I have presented the notion of mimetic schemas, and compared it to different formulations of what appears to be the most fundamental notion in Cognitive Linguistics, image schemas. The comparison was done on six different dimensions: *representation, consciousness, level of abstractness, dynamicity, sensory modality and (inter)subjectivity*, showing that accounts of "what's in a schema" differ along each one of these. I have argued, mostly rather briefly due to limitations of space, for a particular set of values along the dimensions, and thereby explicated mimetic schemas as *dynamic, concrete and preverbal representations, involving the body image, which are accessible to consciousness, and pre-reflectively shared in a community.* In conclusion, I wish to summarize their value as an explanatory concept for Cognitive Linguistics and cognitive science.

First and foremost, they can help explain the "grounding of language". This metaphorical expression which figures in the title of the chapter is often used but seldom defined, and it is high time for me to do so. Mimetic schemas constitute a *ground* for language in the sense that they constitute preverbal mental representations which make language acquisition possible by (a) constituting the first "accessible" concepts (similar to the role that image schemas play in Mandler's model), (b) allowing the insight that others have similar mental representations, which is a prerequisite for having communicative intentions and (c) bootstrapping the acquisition of the meaning of verbs, which is essential for the acquisition of grammar, as pointed out by Tomasello:

> … the acquisition of verbs as single-word lexical items during the 2nd year of life is the major turning point in children's transition to adultlike competence. The grammatical valancies contained in children's first verbs simply "beg" to be completed into sentences. (Tomasello 1992: 7)

At the same time, mimetic schemas do not *constitute* linguistic meanings (see also Dewell, *this volume*), as the latter are not only pre-reflectively shared, but conventional and systematic in a way that mimetic schemas are not. Thus, the transition from mimetic schemas to image schemas – as defined by, e.g., Grady (*this volume*) – is the transition from pre-verbal to verbal, and from mimetic to post-mimetic.

Second, mimetic schemas can help explain the source of human cognitive uniqueness, providing a "ground" for the evolution of language. In line with Donald's (1991) original proposal, the notion of bodily mimesis can help explain why language is so difficult for our animal relatives, including even

"enculturated" apes. In contrast, if image schemas are defined as structures of general *animal* sensorimotor cognition (Johnson and Rohrer *in press*; Dodge and Lakoff, *this volume*) which "map" onto linguistic meanings, it becomes a mystery why animals are not language users…

Third, if mimetic schemas continue to operate even after language acquisition (as assumed within the present model), rather than only play the role of Wittgenstein's famous ladder that is "kicked away" after climbing it, that could explain the ubiquity of co-speech gesture (McNeill 1992). My hypothesis is that mimetic schemas underlie both speech and gesture, thereby accounting for the close synchronization of the two modes of expression. However, while speech is conventionalized and (semi-) compositional, gesture is largely analogue and "holistic", since it is more closely based on the structure of mimetic schemas. At the same time, co-speech gestures are at least partly *post*-mimetic, since due to their synchronization with speech they gain some language-specific characteristics (Kita and Özyürek 2003).

Fourth, mimetic schemas are consistent with evidence concerning cognitive development and language acquisition in impaired populations. They predict that deaf children should not be affected, and would create a language even if lacking "linguistic input", and that blind children given bodily and verbal interaction will not be cognitively and linguistically retarded. Since they are not sensorimotor structures but conscious "simulations", even children with severe motor impairments would be relatively unaffected. Conversely, image schemas – either in Mandler's largely vision-based model, or in the Piaget/Johnson sensorimotor activity-based model – are relatively more problematic to reconcile with the clinical evidence. On the other hand, the problems of children suffering from *autism*, with difficulties in socialization, communication and imagination could possibly be explained as the result of impairment in bodily mimesis, which should be crucially implicated in these three cognitive domains.

Fifth, if language is based on (without being reduced to) mimetic schemas, one would expect exactly the kind of evidence that has been accumulating from research in experimental psychology and neuroscience lately, showing that language use engages "motor representations", as well as the corresponding brain regions (Barsalou 1999; Rohrer, *this volume*). At the same time, this evidence does not imply that all symbolic and inferential processing is carried out by sensorimotor categories and brain regions, as claimed by, e.g., Lakoff and Johnson (1999), or Johnson and Rohrer (in press), since that would make it impossible to explain the qualitative difference between animal and human cognition.

Sixth and finally, mimetic schemas as a ground for public, conventional symbols can help explain how both "cognitive" (representational) and "affective" (experiential) meaning can be communicated through language, since both aspects can be – to various degrees – shared by communicators with similar bodily experiences, giving rise to the "the flesh and blood of meaning" (Johnson, *this volume*). At the same time, since mimetic schemas involve the body image and not (only) the body schema, they could explain the (unfortunate) possibility of a disassociation between denotation and connotation, which both clinical and everyday experience bears witness to.

Finally, it is possible that I am aiming too high and that by proposing a concept, and the outline of a theory, that is meant to explain so much, I have failed to acknowledge many problematic issues in each one of the fields involved in the discussion. But this is something that only further research can show. All that I claim to have offered is a *promising* concept, and in particular one that does not suffer from some of the problems of the various accounts of image schemas that exist in the Cognitive Linguistics literature, most of which have been gathered in the present volume.

References

Arbib, Michael
2003 The evolving mirror system: A neural basis for language readiness. In *Language Evolution*, Morten Christiansen, and Simon Kirby (eds.), 182-200. Oxford: Oxford University Press.

Barsalou, Lawrence W.
1999 Perceptual symbol systems. *Behavioral and Brain Sciences* 22: 577-660.

Bowerman, Melissa
1996 Learning how to structure space for language – A cross-linguistic perspective. In *Language and Space*, Paul Bloom, Mary A. Peterson, Lynn Nadel, and Merrill Garret (eds.), 385-436. Cambridge, Mass.: MIT Press.

Chalmers, David
1996 *The Conscious Mind*. Oxford: Oxford University Press.

Clark, Herbert
1996 *Using Language*. Cambridge: Cambridge University Press.

Clausner, Timothy, and William Croft
1999 Domains and image schemas. *Cognitive Linguistics* 10: 1-32.

Corballis, Michael C.

2002 *From Hand to Mouth: The Origins of Language.* Princeton: Princeton University Press.

Choi, Sonya, and Melissa Bowerman

1991 Learning to express notion events in English and Korean: The influence of language-specific lexicalization patterns. *Cognition* 41: 83-121.

Damasio, Antonio

2001 *The Feeling of What Happens. Body, Emotion and the Making of Consciousness.* London: Vintage.

Deacon, Terry

1997 *The Symbolic Species: The Co-Evolution of Language and the Brain*. New York: Norton.

Deane, Paul

1994 *Grammar in Mind and Brain. Explorations in Cognitive Syntax.* Berlin: Mouton de Gruyter.

Donald, Merlin

1991 *Origins of the Modern Mind. Three Stages in the Evolution of Culture and Cognition*. Cambridge, Mass.: Harvard University Press.

Edelman, Gerald

1992 *Bright Air, Brilliant Fire: On the Matter of the Mind.* London: Basic Books.

Evans, Vyv

2003 *The Structure of Time. Language, Meaning and Temporal Cognition.* Amsterdam: Benjamins.

Fodor, Jerry A.

1981 *Representations.* Cambridge, Mass.: MIT Press.

Fouts, Roger

1973 Acquisition and testing of gestural signs in four young chimpanzees. *Science* 180: 978-980.

Gallese, Vittorio and George Lakoff

2005 The brain's concepts: The role of the sensory-motor system in conceptual knowledge. *Cognitive Neuropsychology* 22: 455-479.

Gallese, Vittorio, Christian Keyners, and Giacomo Rizzolatti

2004 A unifying view of the basis of social cognition. *Trends in Cognitive Sciences* 8: 396-403.

Gallagher, Shaun

2005 *How the Body Shapes the Mind*. Oxford: Oxford University Press.

Gurwitsch, Aron

1964 *The Field of Consciousness*. Pittsburgh: Duquesne University Press.

Grady, Joseph E.

1997 Foundations of meaning: Primary metaphors and primary scenes. Ph.D. dissertation at the University of California, Berkeley.

Heine, Bernard, and Tanya Kuteva
2002 On the evolution of grammatical forms. In *The Transition to Language*, Alison Wray (ed.), 376-397. Oxford: Oxford University Press.
Hume, David
2000 Reprint. *A Treatise of Human Nature*. David Norton, and Mary Norton (eds.). Oxford: Oxford University Press. Original edition, 1739.
Itkonen, Esa
2003 *What is Language? An Essay in the Philosophy of Linguistics.* Turku: University of Turku Press.
2005 *Analogy.* Amsterdam: Benjamins.
Johnson, Mark
1987 *The Body in the Mind*. Chicago: University of Chicago Press.
Johnson, Mark, and George Lakoff
2002 Why cognitive linguistics requires embodied realism. *Cognitive Linguistics* 13: 245-263.
Johnson, Mark, and Tim Rohrer
in press We are live creatures: Embodiment, American pragmatism, and the cognitive organism. In *Body, Language and Mind*. Vol 1. *Embodiment*, Tom Ziemke, Jordan Zlatev, and Roslyn Frank (eds.). Berlin: Mouton de Gruyter.
Jordan, N.
1972 Is there an Achilles heel in Piaget's theorizing? *Human Development* 15: 379-382.
Kita, Sotaro, and Asli Özyürek
2003 What does cross-linguistic variation in semantic coordination of speech and gesture reveal? Evidence for an interface representation of spatial thinking and speaking. *Journal of Memory and Language* 48: 16-32.
Lakoff, George
1987 *Women, Fire and Dangerous Things: What Categories Reveal About the Mind.* Chicago: University of Chicago Press.
1990 The Invariance Hypothesis: Is abstract reason based on image-schemas? *Cognitive Linguistics* 1: 39-74.
Lakoff, George, and Mark Johnson
1999 *Philosophy in the Flesh*: *The Embodied Mind and Its Challenge to Western Thought.* New York: Basic Books.
Landau, Barbara, and Lila Gleitman
1985 *Language and Experience. Evidence from the Blind Child*. Cambridge, Mass.: Harvard University Press.
Lewis, David K.

1969 *Convention: A Philosophical Study*. Cambridge Mass.: Harvard University Press.

Mandler, Jean

2004 *The Foundations of Mind: Origins of Conceptual Thought*. Oxford: Oxford University Press.

McNeill, David

1992 *Hand and Mind: What Gestures Reveal about Thought*. Chicago: University of Chicago Press.

Meltzoff, Andrew, and M. K. Moore

1977 Imitation of facial and manual gestures by human neonates. *Science* 198: 75-78.

1983 Newborn infants imitate adult facial gestures. *Child Development* 54: 702-709.

1994 Imitation, memory, and the representation of persons. *Infant Behavior and Development* 17: 83-99.

Miles, H. Lynn

1990 The cognitive foundations for reference in a signing orangutang. In *"Language" and Intelligence in Monkeys and Apes*, Sue T. Parker, and Kathleen R. Gibson (eds.), 511-539. Cambridge: Cambridge University Press.

Myowa-Yamakoshi, Masako, Masaki Tomonaga, Masayuki Tanaka, and Tetsuro Matsuzawa

2004 Imitation in neonatal chimpanzees (Pan troglodytes). *Developmental Science* 7: 437-442.

Nelson, Katherine, and Lea Kessler Shaw

2002 Developing a socially shared symbolic system. In *Language, Literacy and Cognitive Development*, James Byrnes, and Eric Amseli (eds.), 27-57. Mahwah, NJ: Lawrence Erlbaum.

Newmeyer, Frederick

2003 What can the field of linguistics tell us about the origin of language? In *Language Evolution*, Morten Christiansen, and Simon Kirby (eds.), 58-76. Oxford: Oxford University Press.

Patterson, Francis

1980 Innovative use of language in a gorilla: A case study. In *Children's Language,* Volume 2, Katherine Nelson (ed.), 497-561. New York: Gardner Press.

Piaget, Jean

1962 *Play, Dreams, and Imitation in Childhood*. English translation of *La formation du symbole chez l'enfant* by G. Gattegno and F. M. Hodgson. New York: Norton [French original 1945].

1952 *The Origin of Intelligence in the Child.* New York: Basic Books.

Peirce, Charles S.

1931-35 *The Collected Papers of Charles Sanders Peirce*. Volumes 1-4. Cambridge, Mass.: Harvard University Press.

Regier, Terry

1996 *The Human Semantic Potential: Spatial Language and Constrained Connectionism*. Cambridge, Mass.: MIT Press.

Riviére, James, and Roger Lècuyer

2002 Spatial cognition in young children with spinal muscular atrophy. *Developmental Neuropsychology* 13: 165-184.

2003 The C-not-B error: A comparative study. *Cognitive Development* 18: 285-297.

Rizzolatti, Giacomo, and Michael Arbib

1998 Language within our grasp. *Trends in Neurosciences* 21: 188-194.

Savage-Rumbough, Sue, and Roger Lewin

1994 *Kanzi: The Ape at the Brink of the Human Mind*. New York: John Wiley.

Searle, John

1999 *Mind, Language and Society. Philosophy in the Real World*. London: Weidenfeld and Nicolson.

Senghas, Ann, Sotaro Kita, and Asli Özyürek

2004 Children creating core properties of language: Evidence from an emerging sign language in Nicaragua. *Science* 305: 1779-1782.

Siegal, Michael

2004 Signposts to the essence of language. *Science* 305: 1720-1721.

Singleton, Jenny, Susan Goldin-Meadow, and David McNeill

1995 The cataclysmic break between gesticulation and sign: Evidence against a unified continuum of gestural communication. In *Language, Gesture and Space*, Karen Emmorey, and Judy Reilly (eds.), 287-332. Hillsdale: Laurence Erlbaum.

Sonesson, Göran

1989 *Pictorial Concepts*. Lund: Lund University Press.

in press From the meaning of embodiment to the embodiment of meaning: A study in phenomenological semiotics. In *Body, Language and Mind.* Volume 1. *Embodiment*, Tom Ziemke, Jordan Zlatev, and Roslyn Frank (eds.). Berlin: Mouton de Gruyter.

Stokoe, William C.

2001 *Language in Hand. Why Sign Came Before Speech*. Washington, D.C.: Gallaudet University Press.

Talmy, Leonard

2000 *Toward a Cognitive Semantics*. Volumes 1-2. Cambridge, Mass.: MIT Press.

Thompson, Evan

2001 Empathy and consciousness. *Journal of Consciousness Studies* 8: 1-32.

Tomasello, Michael

1992 *First Verbs: A Case Study of Early Grammatical Development.* Cambridge: Cambridge University Press.

1999 *The Cultural Origins of Human Cognition*. Cambridge, Mass.: Harvard University Press.

Tomasello, Michael, Malinda Carpenter, Josep Call, Tanya Behne, and Henrike Moll

2005 Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences* 28: 675-735.

Varela, Francisco, Evan Thompson, and Eleonor Rosch

1991 *The Embodied Mind. Cognitive Science and Human Experience*. Cambridge, Mass.: MIT Press.

Vygotsky, Lev S.

1978 *Mind in Society. The Development of Higher Psychological Processes.* Cambridge, Mass.: Harvard University Press.

Watt, Roger

1991 *Understanding Vision.* New York: Academic Press.

Ziemke, Tom, Jordan Zlatev, and Roslyn Frank (eds.)

in press *Body, Language and Mind.* Volume 1: *Embodiment.* Berlin: Mouton.

Zlatev, Jordan

1997 *Situated Embodiment. Studies in the Emergence of Spatial Meaning*. Stockholm: Gotab Press.

2003a Polysemy or generality? In *Cognitive Approaches to Lexical Semantics*, Hubert Cuyckens, René Dirven, and John Taylor (eds.), 447-494. Berlin: Mouton de Gruyter.

2003b Meaning = Life (+ Culture). An outline of a unified biocultural theory of meaning. *Evolution of Communication* 4: 253-296.

in press Embodiment, language and mimesis. In *Body, Language and Mind.* Volume 1. *Embodiment*, Tom Ziemke, Jordan Zlatev, and Roslyn Frank (eds.). Berlin: Mouton de Gruyter.

Zlatev, Jordan, Tomas Persson, and Peter Gärdenfors

2005a *Bodily Mimesis as "the Missing Link" in Human Cognitive Evolution*. LUCS 121. Lund: Lund University Cognitive Studies.

2005b Traidic bodily mimesis is the difference. Commentary to Tomasello et al. *Behavioral and Brain Sciences* 28: 720-721.