Pragmatism, Ideology and Embodiment: William James and the Philosophical Foundations of Cognitive Linguistics

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1. Introduction

Much as I dislike beginning a paper with prefatory remarks, it seems equally important to note that we must make a fundamental distinction between work which uses the techniques and methods of cognitive linguistics to analyse ideology, and that which focuses on questioning the philosophical foundations and ideological systems implicit within cognitive linguistics itself. Put in a pithy nutshell, this is the distinction between thinking about the cognitive linguistics of ideology on one hand and the ideology of cognitive linguistics on the other. Yet this distinction is basic to understanding how these two types of projects proceed, and the organisation of these two volumes reflects this distinction. In this article I address some issues within the philosophical foundations of cognitive linguistics, while in an article in the other volume of this collection I use the methods of cognitive linguistics to analyse some ideological systems (Rohrer, Forthcoming 2000b).

In this article I review several of the different senses of the way the word 'embodiment' is currently used in cognitive linguistics, and argue for a broad theoretic framework which ties cognitive linguistics to the larger enterprise of cognitive science. I take research on spatial frames of reference as my primary topic of analysis because it is important to show that the embodied approach to cognitive linguistics is much more than simply a set of hypotheses within one of its most prominent theories, conceptual metaphor (for previous related work on this topic within cognitive semantics see Rohrer, Forthcoming 2000a). I trace the topic of spatial frames of reference through all the multiple levels of investigation implicit in the conception of cognitive science as a multi-disciplinary enterprise which ranges from anthropology all the way to comparative neuroanatomy. I conclude that both cognitive linguistics and cognitive

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science can benefit from the principled application of this theoretic framework.

2. Squirrels doing metaphysics

In his second lecture on Pragmatism, the philosopher William James introduces the pragmatic method as settling a metaphysical dispute about the meaning of the English phrase 'to go round the squirrel' (James 1907) James' squirrel example is a brilliantly lucid description of the ambiguity of some of the kinds of spatial frames of reference used by human beings. He writes:

> Some years ago, being with a camping party in the mountains, I returned from a solitary ramble to find every one engaged in a ferocious metaphysical dispute. The *corpus* of the dispute was a squirrel – a live squirrel supposed to be clinging to one side of a tree-trunk; while over against the tree's opposite side a human being was imagined to stand. This human witness tries to get sight of the squirrel by moving rapidly round the tree, but no matter how fast he goes, the squirrel moves as fast in the opposite direction, and always keeps the tree between himself and the man, so that never a glimpse of him is caught. The resultant metaphysical problem now is this: *Does the man go round the squirrel or not*? He goes round the tree, sure enough, and the squirrel is on the tree; but does he go round the squirrel? In the unlimited leisure of the wilderness, discussion had been worn threadbare. Everyone had taken sides, and was obstinate; and the numbers on both sides were even. Each side, when I appeared therefore appealed to me to make it a majority. Mindful of the scholastic adage that whenever you meet a contradiction you must make a distinction, I immediately sought and found one, as follows: "Which party is right", I said, "depends on what you *practically mean* by 'going round' the squirrel. If you mean passing from the north of him to the east, then to the south, then to the west, and then to the north of him again, obviously the man does go round him, for he occupies these successive positions. But if on the contrary you mean being first in front of him, then on the right of him, then behind him, then on his left, and finally in front again, it is quite as obvious that the man fails to go round him, for by the compensating movements the squirrel makes, he keeps his belly turned towards the man all the time, and his back turned away. Make the distinction, and there is no occasion for any farther dispute. You are both right and both wrong according as you conceive the verb 'to go round' in one practical fashion or the other."

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> Although one or two of the hotter disputants called my speech a shuffling evasion, saying they wanted no quibbling or scholastic hairsplitting, but meant plain honest English 'round,' the majority seemed to think that the distinction had assuaged the dispute.
>
> I tell this trivial anecdote because it is a peculiarly simple example of what I wish now to speak of as the pragmatic method. (James 1907: 17)

What is unmistakable here is not only that James is giving us a sophisticated cognitive semantics analysis of two meanings of the English verb-particle construction 'to go round', but also that James will use this analysis to draw a larger philosophical point about the methods of inquiry. While I will be doing much the same in this paper, let us first diagram the spatial situation to which James' example refers.

James' initial point is that there are two equally rational spatial frames of reference in which the problem may be considered: a *geocentric* frame of reference, in which it is possible to go around the squirrel with reference to the four cardinal directions; and an *object-centred* frame of reference, in which it is possible to go around the squirrel with reference to its front, left side, back and right side. This sort of second spatial reference involves projecting the relations of left/right and front/back from the speaker's body onto the squirrel's body for use as the directional landmark. In both cases, the person is the trajector while the squirrel is an important landmark. However, the frame of reference changes from one case to the other: in one case, the frame of reference is fixed according to external directional landmarks, while in the other it is fixed with relation to the squirrel's body as the landmark. The situation could be schematically drawn as in Figure 1.

Figure 1. James' squirrel being chased around a tree by a man

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As James notes, there was some grumbling at his solution to this frames-of-reference problem. It is important to see that James' solution involves a point of view shift that is relatively unorthodox for many English speakers, though intelligible and expressible. English speakers typically use a third frame of reference that is *viewer-centred* – that is, relative to the speaker's point of view. By contrast, the geocentric frame of reference often makes use of an overhead or bird's-eye or god's-eye point of view. Seen in these terms, the object-centred frame of reference takes up a point of view situated at the object – in this case, it takes up the squirrel's point of view. Notice that changing who the speaker is makes the viewer-centred frame of reference ambiguous: in one condition the conclusions line up with the object-centred frame of reference, in the other with an absolute frame of reference. If, on one hand, the speaker is the man trying to go around the squirrel, he fails in that from his vantage point he never can view the squirrel's backside. If, on the other hand, the speaker is some other person who is viewing the situation from a standpoint external to the immediate scene of action, the man succeeds in that his path has circumnavigated the squirrel. Shifting the point of view from which the frame of reference is anchored provides an easy entry into understanding how such confusions arise.

I mention the matter of point of view with respect to James' example because of a recent controversy in cognitive linguistics. Claudia Brugman (1985) and George Lakoff (1987; see also related work in MacLaury 1989) have claimed that in Mixtec, a Mayan language which exclusively uses body-part morphemes to indicate the spatial relations performed by English prepositions, the resulting frames of reference system is not only an object-centred one, but one which on the face of it appears to be metaphoric. The claim is that speakers of Mixtec systematically understand spatial relations by metaphorically projecting body-part orientations onto other entities in the world. An example quoted from Lakoff's (1987: 313) summary of Brugman's research, would be that *The stone is under the table* requires saying the stone is proximal to the table's belly (*yuu wa hiyaa cii-mesa* / *stone the be-located table-belly*). While English does not normally systematically construct spatial relations in the way, many such metaphoric expressions are lexicalised: mountains may have a foot, faces, and shoulders, while rivers have mouths, arms, beds.

Such evidence fits with a key component of Lakoff and Johnson's embodiment hypothesis; namely, the view that abstract concepts are given meaning through a mapping process from more embodied domains. At first blush, a metaphoric mapping from body parts to spatial relations appeared

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to be similar to the directionality of projection noted in the vast majority of other conceptual metaphors. When taken together with the basic fact that in the neuroanatomy of the visual system all the information received by the visual system is first centred about the viewpoint of the person viewing the situation in the retinotopic maps, such evidence bolstered their claim that the evidence from body-part languages showed that a prior viewer-centred frame of reference must be projected in order to form the object-centred frame of reference. This evidence gave a certain initial plausibility to the Lakoff-Brugman hypothesis that frames of reference may be projected. Near the close of this article I will return to the question of how the current evidence in neuroscience bears on the plausibility of their proposal.

But the philosophical question I wish to raise first is even more fundamental: Why should names for body parts constitute a more basic source domain than the body interacting with space? Though originally taken as a metaphoric projection, much related investigation has fundamentally called into question whether this kind of spatial reference in Mayan languages is the result of a metaphoric projection. In the next section of this paper, I discuss two prongs of research which each argue that it is not a case of metaphoric extension. I then use this controversy to instigate a deeper philosophical discussion about the core hypotheses of cognitive linguistics; namely, that its embodiment hypothesis is a much broader philosophical position than simply the one claim that much of language and cognition is structured by conceptual metaphors. Frames of reference are an excellent example of embodied cognition that can be metaphoric, but that are not necessarily so; and so I use this example to develop a broader theory of what the term 'embodiment' means within cognitive linguistics.

3. Metaphysics, geometry, and developmental cognition

Claims concerning spatial frames of reference have long fascinated linguists, some of whom have been searching for metaphysically 'primitive' or 'universal' frames of reference to which the diversity of the actual occurring systems of reference-framing within the world's languages might be typologically reduced. However, only recently have attempts been made to address these issues within the broader framework of cognitive science. One of the most important of these is represented by a group of scholars centred around the Max-Planck Institute for Psycholinguistics. While much of this work is not explicitly within the rubric known as cognitive linguistics (see particularly Levinson's (1994) trenchant criticisms of the cognitive linguis-

tics account of body-part locative terms as metaphoric), it has grown up alongside and crucially interacting with that tradition. By contrast, the second set of studies is centred about a developmental account of spatial cognition. These studies were conceived within the scope of cognitive linguistics and were in part intended to inquire philosophically into the scope of its embodiment hypothesis.

In a review of their survey of the cross-cultural variation in languages, Pedersen, Danzinger, Wilkins, Levinson, Kita and Senft (1998) observe that language communities vary as to whether and how frequently these two frames of reference are used in describing spatial situations. From a series of cross-cultural interviews in which language informants were asked to describe the relationship between a man and a tree, the researchers developed a typology of languages according to the frames of reference that were present in the language and, in languages where both the absolute and relative frames of reference were present, according to which frames of reference were predominantly used within communities of language informants. (Their terminology of *absolute*, *intrinsic* and *relative* frames of reference roughly parallels the typology of geocentric, object-centred and viewer-centred I have given above.[1]) For example, Dutch and Japanese speakers regularly provided information drawn from the relative (or viewer-centred) frame of reference, in which the speaker's left/right are regularly used in describing the objects in the photograph. By contrast, informants from languages such as Tzeltal and Longgu provided information which relied on either the geographic information in the photo or on fixed bearings such as cardinal directions, and therefore from an absolute (or geocentric) frame of reference.

What is particularly admirable about their research program, however, is that it does not stop with a cross-linguistic typology. Instead, their work exemplifies the contemporary cognitive science paradigm of attempting to synthesise typological results in cross-cultural linguistics with the experimental tradition in cognitive psychology, and even eventually with evidence concerning the frames of reference in neuroscience. One sample task described in Pedersen, Danzinger, Wilkins, Levinson, Kita and Senft (1998) is the animals-in-a-row task, in which the subjects were asked to remember an array of three toy animals on a table that were arranged on a rectangular table in a line facing either to the subject's left or right. Subjects were then asked to turn 180 degrees around and reconstruct the scene exactly as they had seen it. Speakers of the languages which primarily use the relative frame of reference regularly reconstructed the scene so that the animal that had been on their left was still on their left, and so on –

maintaining the order of the animals relative to their own bodies. By contrast, speakers of the languages which primarily use the absolute frame of reference regularly reconstructed the scene so that the animal which was to south end of the table was to the south, and so on – maintaining the order of the animals with respect to the orientation of the table or to the geocardinal directions. From this and related experiments, Pedersen et al. argue that the linguistic variation as to which frame of reference is preferred strongly influences which spatial frame of reference is used in solving conceptual problems.

I mention these studies from psycholingistics for two reasons. The first is to show why Levinson believes that the typology argues against the notion that the relative system is basic to languages and is metaphorically projected, while the second is to illustrate that the problem of differing levels of investigation within the many disciplines of cognitive science is non-trivial. With respect to the first point, Levinson and Brown (1994) have given a historical survey which traces the argument that the relative frame of reference is universal to human cognition back to Immanuel Kant (1768). The typological data gathered by the Max Planck group, however, finds that there are Mayan and Austronesian languages which use intrinsic (or object-centred) frames of reference alone (summarised in table 5 of Pedersen 1998: 572). If the relative system does not occur in all languages, then this appears to be prima facie evidence that the relative system is not universal to human linguistic cognition.

However, when this finding is considered alongside the previously mentioned fact that since all vision starts off as viewer-centred, it poses a cognitive puzzle about why an object-centred (or intrinsic) system occurs by itself in some languages. Levinson (1994: 840-845) considers this puzzle briefly and initially proposes it could be the natural outcome of a modular visual system in which the object-centred neural maps that perform object recognition in the visual system operate as an intermediary level of representation that can interact with language processing, while lower-level visual processing containing the viewer-centred maps does not. Importantly however, Levinson continues by pointing out a flaw in his first solution, namely that Tzeltal body-part terms are sensitive to various spatial primitives in the intrinsic geometry of objects. These spatial primitives consist of items such as the relative internal axes and specific shape contours used by such viewer-centred maps. Levinson (1994: 843) stops short, however, of rejecting modularity outright, even while admitting that his evidence would have to be stretched to support it. Ultimately, however, it is this allegiance to the Marr-ian theory of vision with its strict emphasis

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on the modular and bottom-up algorithmic neural computation of visual properties that leads his criticisms of metaphor theory astray.

Levinson's biases lead him to reject, on erroneous grounds, the Lakoff-Brugman proposal that the intrinsic (or object-centred) system of spatial reference is constituted by a metaphoric projection of a supposedly more basic relative (or viewer-centred) frame of reference system. The reasoning here is faulty because Levinson's rejection of the metaphoric character of this projection falls into a levels of investigation trap. Metaphor, in the Lakoff and Johnson sense, is not "some loose analogy" (Levinson 1994: 812) which takes place solely on the level of language as it would in traditional theories of metaphor viewing metaphor as deviant figurative language, but instead a phenomenon which takes place on multiple levels of investigation. Based on his mistaken impression that conceptual metaphor is a high-level and top-down hypothesis, Levinson (1994: 807-812; 833-836) argues that explanations given on metaphoric grounds are too unconstrained and hence overly generative of possible mappings which do not occur as regular morphemic markings in Tzeltal (and when such mappings do occur they are clearly deviant and figurative). But in fact Levinson's analysis of the geometric constraints on Tzeltal is quite a bit closer to the kind done by conceptual metaphor theorists. What Levinson omits is a careful discussion of how Johnson's image schemata (1987: 29) constrain the mappings of conceptual metaphors. Image schemata, proposed on philosophical, neural, cognitive and developmental psychological grounds (see Rohrer 1998: Chapter 5), posit many of the same sort of geometric structures that Levinson's analysis emphasises as spatial primitives of the visual system. Though these proposals do differ as to the specific structures proposed, the particular content of Levinson's proposals about what these spatial primitives might be are highly image schematic in nature. Taking conceptual metaphor theory apart from its sister theory of neurally instantiated image schemata ensnares Levinson in the levels of investigation trap, and thus illustrates why this problem is a non-trivial one for those of us working in the cross-disciplinary paradigm of cognitive science. I will offer a theoretic framework meant to address this problem in a subsequent section.

However it is also important to acknowledge that, even despite the similarities that Levinson's argument overlooks, the two underlying proposals are not entirely equivalent. Deep philosophical differences remain concerning the modular and algorithmic rigidity that informs Levinson's theoretical outlook on neural processing. For example, because Johnson's image schemata are explicitly conceived as crossmodal patterns, they might

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not be modular enough to suit Levinson's philosophical predisposition toward modularity. The furious philosophical debates over the purported modularity of language (or, alternatively, the contributions of perceptual processing to linguistic processing) remain an open controversial question in neuroscience, though they are gradually yielding to experimental definition. In sum, it is probably fair to say that while it appears that there may be much more contribution from perceptual processing to linguistics than traditional theories of language supposed, much remains to be learned about the extent to which and precisely how such contributions occur.

The developmental evidence from language acquisition studies provides a more subtle critique of the Lakoff-Brugman proposal concerning whether body-part languages rely on a metaphoric projection from a viewer-centred frame of reference onto a target object. Kristine Jensen de Lopez and Chris Sinha (1998; Sinha 1999) have researched whether children learning to speak yet another related Mayan language, Zapotec, acquire body-part morphemes first as body-part terms and then only later metaphorically project them as spatial relations terms. The preliminary analysis of the fieldwork suggests Zapotec speakers in fact acquire them in the reverse order, while Danish and English children acquire them in the order that the Lakoff-Brugman argument suggests. If body-part terms are acquired first as spatial terms by Zapotec children, it contravenes the notion of a metaphoric projection of terms from the body onto objects. Of course, it may still be likely that there is a metaphoric projection of body part terms in languages such as Danish or English that do not normally use the object-centred frame of reference.

In fact, what their study really does is challenge the core conception of embodiment within cognitive linguistics in two key respects. First, the reversed acquisition order suggests that interacting with the spatial world might be just as basic as naming the parts of the body. This is an important insight, if only because from outside cognitive linguistics the embodiment hypothesis is sometimes seen merely as the idea that the body serves as a source of metaphors used for understanding some more abstract target domain. For example, Lakoff and Johnson (1980, 1998) have argued for something we might call the *strong directionality constraint* over what kinds of sources project to the target. In their view, there is normally a unidirectionality of metaphoric projection from more basic bodily source domains to more abstract target domains. Thus, a naive view of the acquisition order evidence might suggest that in this case it looks like a reversal of the strong directionality constraint, i.e. Zapotec speakers use projections from something more abstract – space – to structure something

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more basic, the body. However, this is both a false conclusion and an overly narrow formulation of the embodiment hypothesis. Though the directionality constraint is in fact one important component of the embodiment hypothesis, Lakoff and Johnson have repeatedly emphasised the interactional and pragmatic character of embodiment. The body does not exist by itself, in isolation from the world, but instead develops in contact and through experimentation with it. Seen in the richer light of a broader conception of embodiment that includes the body interacting in space, the debate over the original Lakoff-Brugman claim seems to be somewhat misguided.

Second, and in addition to challenging the overly narrow interpretation of the embodiment hypothesis as simply taking the body in isolation from the environment as the source domain for understanding anything, Jensen de Lopez and Sinha (1998) also push the boundaries of embodiment in another key respect: the contribution of cultural practices. With respect to the cross-cultural differences in acquisition order, Jensen de Lopez currently hypothesises that the difference may derive from differing cultural practices. She notes that Zapotec infants spend most of their first two years in a sling on the mother's back, sharing her spatial perspective, while Danish and English children are placed in cribs and carriages and encouraged more to move about on their own. Consequently, joint attentional episodes during which the child's body parts are named may be less frequent in Zapotec child-rearing practices than in Danish or English cultural practices. In short, she suggests that what might have looked like a projection of self or viewer-centred body-part terms in order to form an object-centred frame of reference is instead simply the raw acquisition of an object-centred frame of reference through joint attentional episodes focused on the spatial characteristics of such objects. While this particular suggestion is still speculative, there is no doubt that language – like a significant portion of human cognition – is learned during joint attentional episodes between infant and caregiver (Sinha 1999, Forthcoming). Establishing shared reference is something that takes place in a cultural context; the developing body exists no more in isolation from people and culture than it exists in isolation from interacting with space.[2] In this sense, the embodiment hypothesis is broadened 'upward,' away from the small scale of neurons and neural circuitry and into the larger scale cultural phenomena of people interacting with one another.

One might question, of course, whether a broadening of the notion of embodiment is useful. Typically, when one broadens a scientific claim one risks making it less predictive and hence less falsifiable. Yet I have

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discussed briefly how evidence from several different levels of analysis – among them the linguistic, conceptual, cultural, neural – as if they all could equally and unproblematically contribute to our understanding the frames of reference puzzle engendered by James' squirrel. My thoughts to this point have thus mirrored James' initial insight as he first answers the question: The problem posed by the squirrel is not so much a metaphysical dispute about the universally true meaning of 'to go round', but a practical problem of how human beings habitually and successfully construct meaningful worlds of shared reference and joint attention.

But just as for James, upon reflection we see that the real problem is how we 'scientist-squirrels' – that is, we 'cognitive linguists' – are to go about doing the metaphysics of our enterprise. By the phrase 'doing metaphysics', I mean only that the squirrel problem brings up deep philosophical issues about the nature of inquiry in cognitive linguistics such as whether and how we can systematically go about tying all these levels of investigation together, or as to what level of investigation is the one at which such frames of reference can be said to exist, or as to what extent different-at-different-levels-yet-still-eerily-similar frames of reference can be reconciled with each other, and so on. So here at last is a difference between James' project and mine: In James' case he uses the squirrel problem to launch a discussion of the conflict between religious belief and scientific inquiry, while in this case I am concerned with what is 'cognitive' about cognitive linguistics. Over the next section of this article I explicitly develop a broad-based framework for research in cognitive linguistics, and subsequently I use this framework to discuss related evidence from fields as diverse as navigation systems and neurology, arguing that there are many good reasons to suppose that all these spatial frames of reference exist as differently embodied systems.

4. The senses of embodiment and the levels of investigation theoretic framework

It is usually wise to begin descriptively before proceeding prescriptively; the following section proceeds accordingly. One relatively uncontroversial fact is that the meaning of one of the most central terms in cognitive linguistics, 'embodiment', is also one of its most hotly contested ones. By my current count, the term 'embodiment' can be used in at least ten different important senses with respect to our cognition. Because theorists often (and sometimes appropriately) conflate these senses, it is important to get a clear

picture of as many as we can of the different dimensions of variability indicated by the term. I would not claim that this list is entirely exhaustive of the term's current usage, nor that these dimensions I identify here are necessarily entirely independent of another or entirely distinct from one another. Thus it is also important to note that this initial survey is not intended to be a prescriptive definition of the term, but instead is intended to catalogue the usage of the term in a way that reveals a number of the most relevant dimensions to which one must be responsive in order to develop a general theoretic framework for the embodiment hypothesis of cognitive linguistics.

1. 'Embodiment' has a *phenomenological* meaning in that it can refer to the things we notice consciously about the role of our bodies in shaping our self-identities and our culture through acts of conscious and deliberate reflection on the lived structures of our experience.
2. 'Embodiment' can refer to the *cultural* contributions and context in which the body, cognition and language emerges and is perpetually situated; similarly, it can refer to the *cultural artifacts* that aid and manifest cognition.
3. 'Embodiment' is also used as shorthand for a counter-Cartesian *philosophical* account of mind and language. Descartes took problems within geometric and mathematical reasoning (such as the meaning of the term 'triangle') as model problems for the study of mind and language, and concludes that knowledge is disembodied—that is, fundamentally independent of any particular bodily sensation, experience, or perspective. From this perspective, the philosophy of language typically consists in (i) mapping the reference relations between idealised mental objects of knowledge and the objects or 'states of affairs' in the real world (as in 'truth-conditional semantics'), and (ii) in discussing the logical internal structure of the relations which hold between these mental objects ('syntax'). Of course, Descartes is by no means unique nor alone within Western philosophy in claiming this position (held in varying forms by Pascal, Russell, young Wittgenstein, Quine, Chomsky and many, many others), but his extraordinary clarity has garnered him the laurel of becoming metonymic for that package of assumptions.
4. 'Embodiment' can also mean what Lakoff and Johnson (1998) have recently called the *cognitive unconscious*. Here 'embodiment' refers to the ways in which our conceptual thought is shaped by many processes below the threshold of our active consciousness, usually as revealed through experimental psychology. For example, psychologists

have investigated what frames of references English speakers are biased to for the spatial term 'above' (Carlson-Radvansky and Irwin 1993).

5. In a *neurophysiological* sense, the term 'embodiment' can refer to the particular neural structures and regions which accomplish feats like metaphoric projection, the integration of image schemata, object-centred versus viewer-centred frames of reference in the visual system, and so on.
6. 'Embodiment' can also be taken to refer to *neurocomputational* models of language, particularly with respect to conceptual metaphor. Such neural networks may be said to be embodied in two ways. First, they may more or less closely model the neurobiology of the neural circuitry they seek to emulate. Second, they may use as their input structures the output from maps of better understood embodied neural structures, typically from within the perceptual modalities. Zlatev (1997) has studied how neural nets can acquire spatial relations terms and frames of reference. Other examples of the neurocomputational sense of embodiment include Howard (This volume) on the biasing inherent to prototype representations as well as efforts by the Neural Theory of Language group at Berkeley (see summary in Lakoff and Johnson 1998, Regier 1995, Narayanan 1997, Bailey 1997).
7. The next two senses both highlight variability along the often neglected temporal dimension as well as along the dimension of physical size. Thus in yet another important sense 'embodiment' can refer to the *developmental* changes that the organism goes through as it transforms from zygote to fetus, or from child to adult. Research on the acquisition course of spatial relation terms (Lopez de Jensen and Sinha 1998) would be an example of the developmental dimension.
8. Another important sense of the term 'embodiment' refers to the *evolutionary* course of development the species of organism has undergone throughout the course of its genetic history. For example, an account of the gradual differentiation of information into separate multiple maps each representing a different frame of reference in the visual system of mammalian evolution would be an evolutionary explanation of multiple frames for spatial reference. Or on an even grander scale: human beings have presumably not always had a language capability, and so evidence from studies on the evolutionary dimension of embodiment may often prove crucial to understanding why, for example, language processing in the brain does not appear to be exclusively concentrated as an autonomous module but instead draws on numer-

ous subsystems from the perceptual modalities (see Deacon 1997; Edelman 1992; Donald 1991 for treatments).

9. A particularly influential sense of 'embodiment' stems from Lakoff and Johnson's (1980: 112) early formulation of the embodiment hypothesis as being a constraint on the *directionality of metaphor mappings*. In this strong directionality constraint they claim that we normally project image-schematic patterns of knowledge unidirectionally from a more embodied source domain to understand a less well understood target domain.
10. However, I think there are actually two senses of embodiment worth distinguishing in the previous point. In its original formulation the embodiment hypothesis was first stated as a generalisation about the *kinds* of basic conceptual domains which were generally serving as source domains, rather than as explicitly referring to the directionality of *projection* for each and every element mapped within a particular metaphor. We might call this sense of embodiment *the directionality of explanation* to distinguish it between from the previous sense. This sense is also similar to that stated in Lakoff and Turner's grounding hypothesis, in which they argued that meaning is grounded in terms of choosing from a finite number of semantically autonomous source domains (Lakoff and Turner 1989: 113-120).

I should mention again in closing that this list is not meant to be entirely exhaustive of the usage of the term 'embodiment,' but rather to illustrate that the scope of the embodiment hypothesis requires thinking through evidence drawn from a multiplicity of perspectives on embodiment, and from multiple methodologies. Of course almost no researcher or research project can attend to all these different senses of the term and produce sound scientific findings; but, at minimum, a review of the literature on any given topic in cognitive linguistics needs to take account of all these dimensions. Of particular interest of course, are research projects that build bridges or perform parallel experiments across these differing dimensions.

It is my contention that much of the confusion stemming from this situation of multiple overlapping dimensions of the term 'embodiment' might be alleviated if research in cognitive linguistics were conceived in a broad-based theoretic framework. In developing a broader theoretic framework for use in cognitive linguistics, I have made use of Posner and Raichle's (1994) schematisation of the levels of investigation in cognitive science as a broad theoretic framework for cognitive linguistics (Figure 2). The most basic organising criterion of my theoretic framework is the scale

of the relative physical sizes of the phenomena which produce the different kinds of cognitive or neural events to be studied. Size is mapped on the y-axis, providing a relative distribution of the 'higher to lower' levels of cognitive processes. To provide clarification, in the next column I provide examples of what the relevant physiological structures are at a given physical scale. I describe the 'Level of Investigation' in accordance with the kinds of cognitive processes studied at that order of magnitude. A general name of each level is indicated by boldface type.

Because I want to preserve Posner and Raichle's deep insight that it is profitable to consider how the experimental tasks change at various levels of investigation, the 'Tasks' column of this theoretic framework specifies for conceptual metaphor theory in particular some typical relevant experimental tasks. Where the notion of an experimental task does not apply, I provide some other relevant foci of analysis. In the next column I describe some of the relevant theoretic constructs operative at the level of investigation, while in the final column I identify some of the various methods used to study phenomena at that level of investigation.

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Size	Physiological Structures	Level of Investigation	*Typical Frames of Reference Theory Tasks*	*Sample Operative Theoretic Constructs*	*Sample Methods of Study*
1 m and up	Multiple Central Nervous Systems	**Communicative and cultural systems** in anthropology, language, science and philosophy	Navigational problem-solving, speakers communicating about the spatial locations of men and trees	Geocentric, viewer-centred and other frames of reference in mapmaking; and in language	Linguistic analysis, cross-linguistic typology, textual analysis, discourse analysis, cognitive anthropology
5 m to 2 m	Central Nervous Systems	**Performance domain;** Cognitive, conceptual, gestural and linguistic systems as performed by individual subjects	Reproducing spatial relations as in the Animals-in-a-row and related task; gestural tasks such as the Sylvester and Tweety Bird task	Geocentric, relative and other frames of reference in language and cognition	Verbal report, observational neurology and psychiatry, discourse analysis, cognitive and developmental studies examining reaction time (RT)
10^{-1} m to 10^{-2} m	Gross to medium size neural regions (anterior cingulate, parietal lobe, etc.)	**Neural systems**	Activation course in somatosensory, auditory, and visual processing areas when processing spatial relations tasks	Neglect; parietal lobe	Lesion analysis, neurological dissociations, neuroimaging with fMRI and PET, ERP methods, neurocomputational simulations
10^{-2} m to 10^{-4} m	Neural networks, maps and pathways	**Neuroanatomy;** Neural circuitry in maps, pathways, sheets	Neuroanatomical connections from visual, auditory, somatosensory regions to language areas	Spatial location and object recognition maps	Electrocellular recording, anatomical dyes, neurocomputational simulations
10^{-3} m to 10^{-6} m	Neurons, Cortical columns	**Neurocellular systems;** Cellular and very small intercellular structures	Fine neuroanatomical organisation of particular structures recruited in the processing	Orientation-tuning cells; ocular dominance columns	Electrocellular recording, anatomical dyes, neurocomputational simulations
Less than 10^{-6} m	Neurotransmitters, ion channels, synapses	**Subcellular systems;** subcellular, molecular and electrophysical	None--beyond theoretical scope	Neurotransmitter, synapse, ion channels	Neuropharmacology, neurochemistry, neurophysics

Figure 2. Theoretic framework for the embodiment hypothesis in cognitive science as applied to spatial frames of reference

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In addition to spatial frames of reference, this framework can be used to structure studies of other topics of interest to cognitive linguists, such as metaphor, mental imagery, categorisation, and so on. This type of theoretic framework is now fairly common within much of cognitive science, but cognitive linguistics has been slow to give explicit attention to the problem of how we are to theoretically situate and reconcile these different levels of investigation.

I should also note that I have explicitly included a level of cultural and communicative analysis. By choosing to include a level situated at 1 m and up relative size scale, I mean to indicate not just the size of physiological structure of the central nervous system of language-producing human beings, but also the standard scale of their interactional distance in speaking with one another. Language is not learned in isolation nor are words uttered in a vacuum, and investigations in cognitive linguistics should include this level of investigation. Finally, while this chart of the framework gives a good overview of the relationship between body, brain and culture, it is not as illustrative for issues pertaining to evolutionary and developmental time scales, which may be considered at any of these levels. However, this is more a limitation of the imagery of the chart than the theoretic framework itself. If we were to add an axis for time perpendicular the surface plane of the chart, we could the imagine this framework as a rectangular solid. I have omitted representing this dimension because such an illustration would make it difficult to label the levels, but I mention it because the time courses of these phenomena is a central dimension to understanding them.

5. Spatial frames of reference and cultural artifacts

To illustrate how this kind of theoretic framework might be applied within cognitive linguistics, I want to first focus on what we might think of pushing the study of spatial frames of reference upward and outward. Thus far, I have reviewed a number of central studies concerning frames of reference and body part languages at the linguistic and cognitive level, but I have not sufficiently demonstrated how the study of spatial frames of reference can benefit from analyses at the cultural and performative levels of investigation that are not narrowly focused on language per se. To this end, I am going to discuss one of the areas in which frames of reference have tremendous practical import: navigation and direction-finding.

We have probably all had the experience of being given ambiguous directions in an unfamiliar locale. For example, in navigating a foreign city

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we might resolve the ambiguous phrase "the theatre is just to the right of the cathedral" in several different ways depending on the frame of reference chosen. Suppose we had just received this response when we asked a native for directions, and then while looking at our map (a geocentric frame) realised that we could arrive at the cathedral by walking due south. Now, because the canonical orientation of a map is to have north at the top, we decided that by 'to the right' the speaker meant that the theatre as being to the east of the cathedral. But suppose we didn't find it there, and after some initial confusion, we concluded that perhaps the speaker had given us path-dependent directions, where 'to the right of the cathedral' should have been resolved relative to our perspective on the situation as we approached the cathedral (a viewer-centred frame). Using this frame of reference, we realised that the theatre might have been to the right of the cathedral as we approached it by walking south, and hence on its west side. Further suppose, however, that this interpretation also fails, for on the west side the cathedral faces a wide-open plaza. Nearing complete confusion, we finally ask another native for directions to the theatre. Her response is to laugh, and to point a building due north of the theatre – a building that we had already walked by twice. In a flash of insight, we finally come to realise that what the first speaker actually meant was that the theatre is to the right of the cathedral according to an object-centred frame of reference. Because this cathedral has a canonical orientation where its front is where the doors open westward onto the plaza, 'to the right of the cathedral' can also mean just to the north of it.

I have constructed the phenomenology of this imagined situation carefully in order to generate a situation in which none of the frames of reference co-align. Interestingly, Sotaro Kita (submitted) has studied how the gestures given in such situations reveal a pre-linguistic process of co-aligning the frames correctly so that accurate directions can be given. His analysis of videotaped gestural data shows that, when facing in a different direction from the path to the destination for the directions they give, people will frequently shift their gaze or even make awkward, torso-twisting or across-body physical gestures in order to imagine better the situation by aligning their viewer-centred frame of reference with the absolute frame of reference.[3] He argues that the gestural evidence reveals that speakers are aligning the frames in order to facilitate the correct linguistic utterance. In other words, people subconsciously prefer to establish co-alignment between the geocentric and the viewer-centered reference frames before giving directions – as supported by the phenomenological experiences of anyone who has ever turned around with a map until both they and the map

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faced north, or who as a direction-giver has subconsciously repositioned themselves so that their orientation matches how they would geographically travel to their destination.

Within cognitive anthropology, Edwin Hutchins (1995) has shown how such spatial frames of reference become embedded in cultural artifacts of knowledge, such as in the geocentric physical charts and maps used by Western navigators or in the viewer-centred conceptual models used by Micronesian navigators. Hutchins (1995: 136) describes how such navigational artifacts can lead to problems in the co-alignment of reference frames:

> While the Palau was steaming eastward, southwest of San Diego Harbor, a quartermaster attempted to identify the Coronado islands, which lay about 7 miles south of the ship. The three islands were clearly visible out the window of the pilothouse just above the chart table. Of the three islands on the chart, the leftmost island was labeled 'North Coronado' and the rightmost one was labeled 'South Coronado.' Because the quartermaster was looking to the south however, North Coronado was on the left in the world (the reverse of their positions on the chart relative to him). By mapping the spatial structure of the chart directly onto the visible world, the quartermaster managed to mistake North and South Coronado for each other.

The navigational chart embeds the geocentric frame of reference into its structure, but because it can be used in a variety of spatial orientations, it is a tool that can also create potentially dangerous mismatches.

The geocentric frame of reference is so central to our Western practices of navigation that most of us could not imagine finding small islands amidst vast oceans without plotting a course to our destination on a chart and checking it repeatedly. Yet the system of navigation developed by the Micronesian peoples for sailing their outrigger canoes among the tiny coral atolls of the southwestern Pacific Ocean utilises a viewer-centred frame of reference coupled with an oral tradition which encodes the relative bearings between islands and the rising and setting points of prominent stars on the horizon (Hutchins 1995: 65-91). This system begins by conceptualising the canoe as moving away from the island, but once the canoe is out of sight from land the canoe no longer moves. Instead, the world moves about the canoe. Hutchins notes that this is true even when the canoe comes in sight of neighbouring islands off to the left and right of the course to the destination – informants report that the islands are moving, not the canoe. In fact, it is the moving islands that are the key to knowing when the canoe has reached the vicinity of the destination, whereupon other navigational

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systems and frames of reference once again come into play. How is it possible that Micronesian navigators can travel for days at a time on the open ocean and yet repeatedly and easily pass the stern test of landfall?

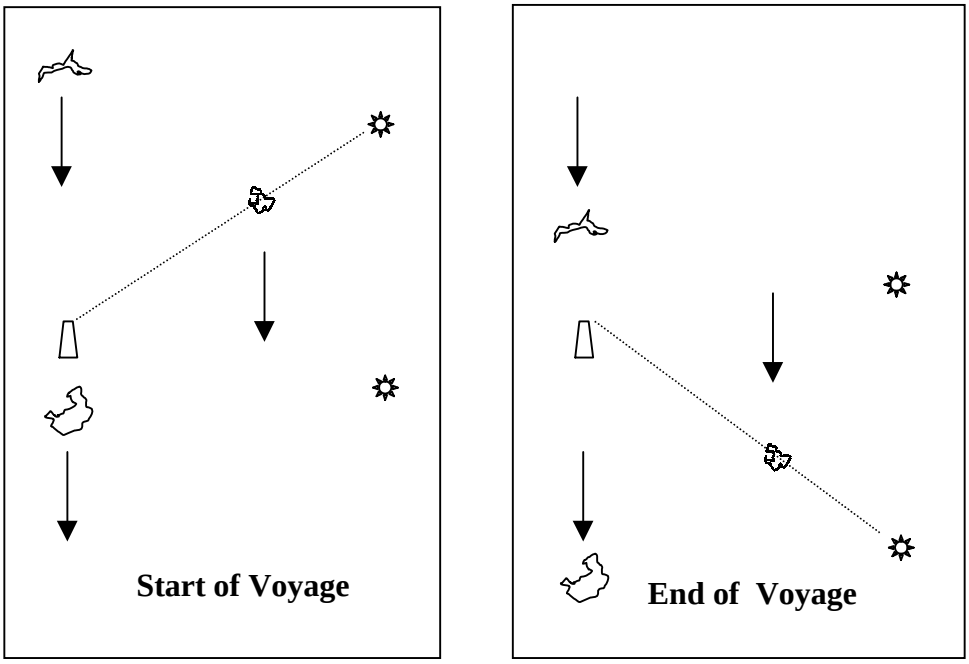

Figure 3. Navigation Using a Viewer-Centred Spatial Frame of Reference. The islands and stars move past the boat. The result of the world moving past the boat for the distance symbolised by the vector is shown in the second frame. Note that the bearing on the island has reached the rising point of the second star; this is how the navigator knows that the voyage is nearing its end. This voyage is highly simplified for schematic purposes; a longer voyage will have multiple segments, navigational islands and bearings. This illustration is an adaptation of those found in Hutchins (1995: 83-91).

Consider the canoe as the stationary standpoint of a viewer-centred frame of reference (see Figure 3). From it, the islands appear to move about the canoe, much as a person sitting in a car might imagine a water tower off some distance to one side moving by the car. (I have chosen this analogy

because I find the feeling of being a passenger on a long car journey is akin to the feeling of effortlessly sailing on the regular swells of the open ocean.) The position of these islands is then tracked in comparison with a yet more distant object, which, in the case of the Micronesian system, is the rising or setting point of certain stars on the horizon; or in our hypothetical analogy to the car passenger, say it is two widely separated peaks of a mountain range paralleling the road. Now, just as over the course of an hour the water tower 'moves past the car' from under the first mountain peak to under the second, at the beginning of the voyage the island is under a particular star's rising point while at the end of it the island is under another star's rising point. From the viewer-centred frame of reference of the navigator, the island has moved relative to fixed points on the horizon, and this is what tells the navigator that the journey is at an end.

One of the interesting side effects of the Micronesian system is that it eliminates the problem of co-aligning the geocentric frame of reference embedded in a map with the perspective given by a viewer-centred frame of reference. The roughly comparable Micronesian artifact is a chant that encodes a series of viewer-centred bearings between islands and the points on the horizon, but because all the information is framed viewer-centrically, there is no possibility of the kind of co-alignment error experienced by the quartermaster. Of course, this is not to say that the Micronesian system of navigation is intrinsically superior to the charts of Western navigators, but it is an illustration of how the design of a cognitive system can serve to eliminate one source of error. Hutchins analyses these systems in considerable detail, arguing that they are examples of *distributed cognition*. In distributed cognition, tasks are both off-loaded onto material and cultural artifacts and are socially distributed across an ensemble of practitioners.

This conception of distributed cognition is a fruitful hypothesis at several levels of investigation, and it is also worthwhile to trace it 'downward' (in terms of physical scale) into levels of investigation focused on the brain. For example, we could conceptualise the relationship between the gestural system and the linguistic system as one which distributes cognition across multiple neural systems which are then co-activated with the appropriate linguistic response. Assuming that the gestural evidence reveals that a person is engaging in a mental imagery task while preparing the linguistic response for giving the relevant directions, this imagery probably utilises regions of the brain already implicated in integrating sensorimotoric information with visual information. The topology of the perceptual imagery involved in co-aligning the reference frames then contributes to choosing the appropriate linguistic response (that is, turn *right* or *left*). Such

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a hypothesis raises questions about just what we know from neuroscience about how the perceptual systems represent spatial frames of reference – a problem to which I now turn.

6. Spatial frames of reference in neuroscience

Among the most significant theoretic discoveries in neuroscience has been the realisation that the brain manipulates perceptual information in image-like wholes. One of the basic principles of neural organisation is *the topological representation of neural maps* – visual, somatosensory, auditory and other perceptual information is represented spatially in neural fields that map perceptual features such as location, motion, the hand, pitch, and so on. The organisational structure of these maps necessarily implies a frame of reference, and the brain expends much effort to update these maps constant given changes in eye movement, head movement, or bodily orientation. As information is passed forward and re-represented in later maps, the information retains much of its original contour patterns; these are the neural bases for Johnson's (1987). image-schematic patterns. For example, visual information is initially represented in a frame of reference centred retinotopically, but then must be adjusted for the direction and size of the next saccadic eye movement (Lee, Rohrer and Sparks 1988), while some later neuronal maps in the ventral intraparietal region (VIP) utilise a head-centred frame of reference, tracking an object's location by preserving the shape contours of the object and simultaneously integrating information from the somatosensory system that encodes the position and movement of the head (Colby and Duhamel 1993). While the problem of how such schemata are continually, represented, transformed and re-represented in multiple frames of reference is the topic of much research in cognitive neuroscience, few attempts have yet been made to bring the work on neuroscience together with research on frames of reference on language.[4] However, a recent survey of some of the relevant literature suggests that the linguistic frames of reference observed at higher levels of cognition may well be embodied with fairly direct neural analogues in spatial cognition (Petersen, Nadel, Bloom and Garrett 1996).

One important source of evidence at what I have called the neural systems level of investigation results from asking questions of neurologically impaired patient populations. Such patients typically have brain lesions resulting either from a stroke or some intrusive traumatic head injury. The loss of brain region typically translates into a loss of function,

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but it can be very difficult to pin down exactly what task is performed by a particular brain region, and not all tasks are necessarily localisable to brain regions. However, patients with lesions in the parietal cortex typically exhibit symptoms of a syndrome called hemineglect. Hemineglect is characterised by reduced attention to the half of space contralateral to the lesion. For example, when asked to copy a clock face and label the hours, a right parietal patient would typically crowd the numbers into the right side of the object while omitting some numbers normally found on the left side. Such deficits are naturally amenable to research as to which spatial frames of reference are used to organise this region of parietal cortex.

Marlene Behrman and collaborators have designed a series of experiments which differentiate between the viewer-centred and object-centred frames of reference for visual stimuli (Behrman and Tipper 1999; Tipper and Behrman 1996; Behrman and Tipper 1994; Behrman and Moscovitch 1994). For example, one such experiment consisted of asking a patient to track the right side of a barbell figure (two circles joined by a horizontal line) as the barbell was incrementally rotated until the right side of the barbell was in the left visual field. Patients were then evaluated to how well they responded to a target presented in either the left or right visual field. This finding shows that "the neglect that was associated with the left side of the object accompanied the object to its new location" (Behrman and Tipper 1999: 84). Target detection was impaired on the left side of the barbell, which was now in the right side of visual space – thus supporting the hypothesis that neglect can take place within an object-centred frame of reference. Together with related experiments, this finding constitutes important evidence that the absolute and relative spatial frames of reference are embodied within the perceptual system. More importantly, it suggests an avenue for further research within the cognitive linguistics paradigm exploring whether damage to this region of the right parietal cortex inhibits language comprehension or production of sentences that use one or the other of these spatial frames of reference. Such research would bear strongly on the question of whether or not language was an autonomous module which did not access the spatial primitives of the perceptual system.

However, it is not yet clear from analysis at the neural system level that these spatial frames of reference are necessarily encoded as separate and distinct maps within the cortex. Behrman and Tipper (1999: 84) caution that if the horizontal line of the barbell is removed from their experiments, the evidence no longer supports object-centred neglect but reverts to viewer-centred neglect. Previous studies on the static pictorial presentation of

rotated objects (Coslett 1989, Behrman and Moscovitch 1994) have shown that objects which have a canonical object-centred frame of reference intrinsic to them, such as asymmetric letters or drawings of a left or a right hand, are more prone to exhibiting object-centred neglect than objects which do not have such canonical orientations (such as symmetric letters or the profile of a cow). In neurocomputational simulations that model the kind of maps found the neuroanatomical level of investigation, Pouget and Sejnowski (1997) have pointed out that it is not necessarily the case that every possible change in spatial frame of reference must be represented in an intermediary map. They present a model of parietal neuron responses as approximated by the product of a Gaussian function of retinal location and a sigmoid function of eye position, arguing that if neuronal maps were organised to take advantage of this mathematics they could represent the position of an object in multiple frames of reference simultaneously. Their simulation demonstrates that it is at least possible that neglect of both kinds might result from a unitary parietal representation that encodes spatial information relevant to both frames of reference.

Once again, however, complications are induced by further evidence at the neuroanatomical and neurocellular levels of investigation. Single-cell recordings from two macaque monkeys, who have a visual cortex closely resembling that of humans, show that there are two adjacent fields of posterior parietal neurons which modulate selectively to body-referenced (viewer-centred) stimuli and world-referenced (geocentric) stimuli (Snyder, Grieve, Brotchie and Andersen 1998). Responses to visual targets were compared from data recorded while the body and head of the monkey had been rotated together to several positions to data recorded with the monkey head position held constant while the body position was counter-rotated; a third condition explored the monkey's own active head rotation to identical targets. The neuronal field of the LIP cortical region responded to the body-referenced information in the body rotation without head rotation condition, while the neuronal field of cortical area 7a responded to the world-referenced information in the body and head rotation condition. This evidence suggests that there are separate representations of visual space which represent object location in different spatial frames of reference; hence animal studies have made the problem more complicated, suggesting separate pathways and representations for the other two spatial frames. Further work might also show the same result for comparison between object-centred and world-centred frames, but as the evidence on the three frames currently stands it tends to support the Lakoff-Brugman view that

the object-centred and viewer-centred frames are more tightly coupled than the viewer-centred and the geocentric frame.

Throughout these last two sections I have not only been illustrating the effect of a principled cross-disciplinary analysis of the different levels of investigation, but have also been making proposals as to how cognitive linguistics could test its hypotheses and benefit from interaction with its sister disciplines in cognitive science. For example, if cognitive linguists could come up with appropriate stimuli which could test for these frames of reference in humans by means of linguistic data, and if Lakoff and Johnson's embodiment hypothesis were correct in supposing that language co-activates the relevant areas of parietal cortex that perform imagery tasks, then it might be possible that linguistic research might contribute to answering this kind of question, even though it is supposedly about a purely perceptual phenomenon. Such experiments would have the advantage of being carried out using the less invasive techniques of functional magnetic resonance imaging and event-related potentials, and might reveal spatially discriminable fields for such frames of reference in humans without requiring further invasive experiments on monkeys. This kind of cross-disciplinary work represents a model project very much in the original spirit of what cognitive linguistics was to be (Lakoff 1987). It is important, however, that cognitive linguistics does not just import evidence from psychology and neuroscience as serious influences which constrain linguistics hypotheses, but actively interacts with those disciplines in order to shape hypotheses within them as well. Only then will cognitive linguistics be not just a listening but a speaking member of the cognitive science family.

7. Conclusion: Toward a PCP-based cognitive linguistics

Though I have argued for importing into cognitive linguistics the broad theoretical framework that resulted primarily from the cognitive neuroscience revolution within cognitive science, I want to make it clear that we should not be blind to some of the poor assumptions in early cognitive science. Much ink has been spilled both within and without cognitive linguistics on the differences between generations of cognitive scientists. Like most caricatures, these differences are usually overdrawn but exist nonetheless. Hutchins argues that theorists "in the classical camp of cognitive science have taken what is called 'a physical symbol system' as the primary architecture of human cognition" (1995: 358). Newell and Simon's concep-

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tion of the brain as a physical symbol system (PSS) was supposed to be an instance of a Turing-like universal machine that could manipulate symbols without any knowledge as to their semantic content, because their semantic content was assumed to be a matter of what 20th-century analytic philosophy had said it was – a simple matter of reference to states of affairs holding in the world and independent of the vagaries physiological apparatus which garnered it. The fact that the view of the brain as essential a symbol processor exists and still holds much sway should not be doubted (see Newell and Simon 1990; for a historical overview see Gardner 1985).

What I am saying about the old guard in cognitive science might seem obvious, but it isn't entirely so. The classical view of cognition states that the mind is fundamentally composed of representations which link symbols to the world, and it is called the classical view for a reason. It is called 'classical' because this conception is an old notion in the philosophy of language that can be traced back to Platonic and Aristotelian philosophies of language and science (Rohrer 1998: Chapter 1). The idealised language would 'cleave nature at its joints,' and refer purely and clearly to the categories as they are in nature, apart from our experience of them. The metaphor, and the accompanying philosophical project, has its roots in Plato. In the *Statesman*, Plato has the Eleatic stranger instruct a young Socrates in the art of definition:

> We must beware lest we break off one small fragment and then contrast it with all the important sections that have been left behind. We must only divide where there is a real cleavage … it is splendid if one really can divide off the class sought for immediately from all the rest – that is, if the structure of reality authorizes such divisions. (Plato: 262b)

Plato's myth of the Eleatic stranger is at the source of one tradition within cognitive science; that given by William James, John Dewey and other American pragmatists is at another. There lies the source of the richly philosophical sense of embodiment, and it is what underlies the theoretic framework I have proposed.

In order to oppose this overly referential view of language and this symbol-minded view of cognition as a PSS, I would propose instead a pragmatic-centred philosophy (PCP) for cognitive linguistics. Just as discoveries in evolution, psychology, and pedagogy drove the philosophical revolution that became American pragmatism, the recent developments in cognitive science and cognitive neuroscience can drive a PCP-based cognitive linguistics. If, as good pragmatists, we see language not as some

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magical special ability of a rationality which sets homo sapiens apart from the animals but instead as a well-developed and highly-evolved refinement continuous with the bodily and animal cognition of our past, we might begin to see language as another highly effective cognitive tool developed in the course of our adaptation to a complex yet highly patterned world. It is my view that we should base our explanations of language first and foremost is what gives a shared and mediated world; namely the shared facets of our bodies, brains, development and cultures. Neither the arcane depths of neuroscience nor the heights of cultural analysis are any more real or any less necessary to explaining language. The neurosciences, with all their various apparati, are ultimately focused on patients. Not all deficits are as dramatic as visual neglect, but at the centre of such work lies the suffering patient to whom science is ultimately addressed. Similarly, we can take what we have learned about language – about, for example, the ambiguity of direction finding and apply it to solving simple problems like direction finding. For example, cognitively-inclined computer scientists in Sweden have explored which frames of reference are most suitable for an information kiosk geared toward guiding tourists around an unfamiliar town. Such work can drive a PCP-based cognitive linguistics that is very similar in spirit to Lakoff and Johnson's embodiment hypothesis, and is at the core of the philosophical sense of the term.

Of course, I am not saying that anyone should give up linguistics to become doctors or computer scientists. But as cognitive linguists we can and should interact with them more, and bring them our hypotheses to put to the test. Nor am I saying that we should leave old projects entirely behind, but simply that we should clean off the lenses through which we look at them. The referential capacity of language is important and should be given its due; Sinha (Forthcoming) has recently argued for a theory of the emergence of referential meaning as embedded in the joint attentional episodes taking place between infant and caregiver. But just as important is understanding figuration; how can the object of reference stand out against the backdrop of experience? In my view, research on spatial frames of reference tackles both the problems of reference and figuration, both in the tracking of an object in the visual or somatosensory modalities within cognitive neuroscience and in analysing how language calls our attention to different features of our world within linguistic analyses. It has already taken some steps toward becoming the kind of multi-disciplinary study, even though some of that interdisciplinary work has been done by a severe critic of a central approach within cognitive linguistics. As such, this topic

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is a natural avenue for renewed attention in cognitive linguistics, using the sort of principled theoretic framework I have outlined in this article.

I began this article by quoting a passage about squirrels and frames of reference from the American philosopher William James. It is perhaps fitting that I conclude by continuing that same quote, for like James, I have told

> ... this trivial anecdote because it is a peculiarly simple example of what I wish now to speak of as the pragmatic method. The pragmatic method is primarily a method of settling metaphysical disputes that otherwise might be interminable. Is the world one or many? – fated or free? – material or spiritual? (James 1907: 18)

(To James' list of important questions, I think we might well add: "Is space relative or absolute?" But he continues:)

> – here are notions either of which may or may not hold good of the world; and disputes over such notions are unending. The pragmatic method in such cases is to try to interpret each notion by tracing its respective practical consequences. What difference would it practically make to any one if this notion rather than that notion were true? If no practical difference whatever can be traced, then the alternatives mean practically the same thing, and all dispute is idle. Whenever a dispute is serious, we ought to be able to show some practical difference that must follow from one side or the other's being right. (James 1907: 18)

In the end, my view is that cognitive linguistics could do no better than adopting James' definition of the pragmatic method as its ideological motto. What difference does it make that one can marvel that it is possible to form semantic nonsense phrases such as 'colourless green ideas'? Not a whit. But it can and does make a difference if we can trace semantics and syntax back to our embodied experience of space, or if we could show how perceptual cognition about spatial frames of reference is critically involved in linguistic expression of the same sentences. It makes a practical difference to the person asking directions, to the design of information kiosks which can guide you to museums in foreign cities, to the patient with neglect whose suffering might be eased if we knew more about the ways in which the disorders of spatial frames of reference work.

In short, what really matter are the practical problems of living, and just as such problems drive cognition they should drive explanation. This was the central insight of the pragmatists and it is the one we should adopt. A PCP-based cognitive linguistics thus not only has a pragmatically-centred

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philosophy, but a patient-centred and problem-centred one as well. Cognitive linguistics can and should be vitally engaged with pragmatic problems.

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Notes

1. Though I regret to add more terminology to an already overly jargonesque subject matter, my philosophical differences with their position will eventually require I refrain from adopting their precise terminology. I will however, point out that Levinson (1996) provides a useful survey of the variety of terms employed by neuroscientists, cognitive psychologists, linguists, philosophers and others working on frames of reference.
2. Lakoff and Johnson (1980: 117-119) are quite straightforward on this point, arguing that there are natural kinds of experience, including not only experience of the body but interactions with the physical environment and culture. See chapter 5 of Rohrer 1998 for a review.
3. It is import to note that Kita (submitted) found that speakers make these gestures only in certain restricted situations in which they do not make use of a local landmark. An example of direction-giving which uses a local landmark would be the instruction "turn to the left, in the direction the theater will be".
4. Of course some important exceptions to this rule exist, including research done by Jordan Zlatev (1997) on theoretical cognitive linguistics in conjunction with developmentally-based neural network models. See particularly his account of how spatial relation terms and frames of reference could be acquired by a simple neural network model

trained on a dataset of actual child language utterances. See also the more historical survey on language and neuroscience given by Petersen, Nadel, Bloom and Garrett (1996) as a chapter in their edited volume *Language and Space*. Other articles in that collection, including Levinson (1996) are useful as well, while Levinson (1994) brought work in the neurocomputational modeling of vision together with language. However, none of these efforts explicitly bring to the table the principled approach to synthesizing the research from multiple levels of investigation offered here.

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